SCIENTIFIC REPORT

EFSA Journal

APPROVED: 25 November 2020

doi: 10.2903/j.efsa.2020.6349

Annual Report on surveillance for Avian Influenza in poultry and wild birds in Member States of the European Union in 2019

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Abstract

Context. Avian influenza (AI) is an infectious viral disease that affects all species of domestic and wild birds. The viruses causing this disease can be of high (HPAI) or low (LPAI) pathogenicity and represent a continuous threat to poultry in Europe. Council Directive 2005/94/EC requires EU Member States (MSs) to carry out surveillance in poultry and wild birds and notify the results to the responsible authority. Therefore, MSs, Iceland, Norway, Switzerland and the United Kingdom have implemented ongoing surveillance programmes to monitor incursions of AI viruses in poultry and wild birds. EFSA received a mandate from the European Commission to collate, validate, analyse and summarise the data resulting from the avian influenza surveillance programmes in an annual report. **Poultry.** Overall 24,419 poultry establishments (PEs) were sampled, of which 87 were seropositive for H5 virus strains and 22 for H7 strains. Seropositive PEs were found in eight MSs (Belgium, Bulgaria, Denmark, France, Germany, the Netherlands, Poland, Spain) and the United Kingdom (also a MS at the time of collection). The highest percentage of seropositive PEs was found in establishments raising waterfowl game birds and breeding geese. Out of the 109 PEs with positive serological tests for H5/H7, only two tested positive in PCR and virology for H5/H7 virus strains, both of which were LPAI strains (H5N1 and H7N7, respectively) and were reported by Denmark. In addition, 12 countries also reported PCR results from 653 PEs carried out either as a screening test or subsequent to a negative serological test result. Five of these PEs were found positive for AI viral RNA: four H5N8 HPAI in Bulgaria and one H7N3 LPAI in Italy. **Wild birds.** A total of 19,661 dead/moribund wild birds were sampled, with one bird testing positive to HPAI virus H5N6, which was reported by Denmark. In addition, there were 84 birds testing positive for LPAI H5 or H7 virus and 848 birds testing positive for non-H5/H7 AI virus, reported by 30 countries. The surveillance findings for poultry and wild birds for 2019 are discussed in relation to findings from previous years and current knowledge of the epidemiology of AI in Europe.

Keywords: Avian Influenza, HPAI, LPAI, surveillance, poultry, wild birds

Requestor: European Commission

Question number: EFSA-Q-2020-00729

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Acknowledgements: The EFSA wishes to thank the following for the data and support provided to this scientific output: EFSA AHAW panel, Ausvet, Member State representatives, EURL and Elisabeth Dorbek-Kolin from EFSA.

Suggested citation: EFSA (European Food Safety Authority), Baldinelli F, Papanikolaou A, Stoicescu A, Van der Stede Y and Aznar I, 2020. Annual Report on surveillance for Avian Influenza in poultry and wild birds in Member States of the European Union in 2019. EFSA Journal 2020;18(12):6349, 49 pp. https://doi.org/10.2903/j.efsa.2020.6349

ISSN: 1831-4732

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

Summary

The European Union's Member States (MSs), Iceland, Norway, Switzerland and the United Kingdom (together referred to as reporting countries, RCs) implement surveillance programmes to detect incursions of avian influenza viruses (AIV) in poultry and wild birds, particularly migratory wild birds, which are considered the main source of introduction of AIV to poultry. This is the second report produced under the mandate from European Commission summarising the results of the surveillance activities carried out in poultry and wild birds in 2019, and the first produced with data that were submitted directly to EFSA. The present report summarises the results of the EU co-funded surveillance activities conducted in 2019, which consisted of:

- Serological surveys to monitor the circulation of AIV subtypes H5 and H7 in poultry (active surveillance). These surveys should preferentially target poultry species or production systems with increased risk for introduction of avian influenza (AI).
- Passive surveillance aiming at the virological detection of AI in wild birds found dead or moribund.

In addition, some MSs also reported the results of active surveillance performed by testing living and hunted birds.

AI surveillance in some RCs is based on targeted sampling (non-representative). Therefore, comparisons of seropositivity rates between different groups presented in this report relate to the specific observations recorded (surveillance samples) only. They cannot be extrapolated to the source populations because sampling was targeted at higher risk groups and the targeting approach may be different between countries, between groups and between years. Risk-based surveillance is designed for early detection and should not be used to measure changes in disease prevalence or incidence.

Serological surveys in poultry

A total of 31 RCs reported data on sampling and AI testing in poultry establishments (PEs). In some RCs, establishments were sampled several times throughout the year. For the purpose of this report, each sampling exercise taking place on a specific date and targeting a different poultry category was considered as an independent event and counted as one PE sampled. Therefore, the numbers reported in this manuscript as PEs sampled should be interpreted as the number of sampling events taking place in an RC for each of the reported categories.

Figures on the size of the poultry population under surveillance in the RCs were not available at the time of writing of the present report. In 2019, a total of 24,419 PEs were sampled, an increase compared with the number sampled in 2018 (n = 18,596). The total number of PEs sampled and reported in each RC ranged from 26 in Malta to 5,060 in Italy.

Sixteen poultry categories have been used to report surveillance results in the present scientific report (see details in Appendix A). However, conventional laying hen establishments were sampled by 27 out of 31 RCs. Other poultry categories targeted by most RCs were free-range laying hens, fattening turkeys, breeding chickens and gallinaceous game birds. Growers and breeding geese were targeted by only few countries. In terms of the number of PEs sampled, backyard flocks were the most sampled category (n = 5,896), followed by conventional and free-range laying hens (n = 4,260 and 3,144, respectively).

A total of 109 PEs (0.45%) were seropositive to either H5 or H7 (H5/H7), including 87 H5 and 22 H7. The H5/H7 seropositivity rate was substantially higher than that observed in 2018 (0.24%). Nine countries reported H5 seropositive PEs: Belgium, Bulgaria, Denmark, France, Germany, the Netherlands, Poland, Spain and the United Kingdom. Denmark, Spain and the Netherlands also reported H7 seropositive PEs. All H5/H7 detections occurred in countries which sampled a number of PEs larger than the median number of PEs sampled. Surveillance results were reported at the NUTS3 level by most countries, allowing for a detailed mapping of the sampling distribution.

As observed in 2018, waterfowl game birds and breeding geese were the categories with the highest proportion of H5/H7 seropositive establishments (20.5% and 5.1%, respectively). The proportion of H5/H7 seropositive PEs was much lower in all other categories, from 0.02% in backyard flocks to 1.4% in flocks categorised as others. No positive PE was found in the following categories: turkeys (fattening and breeding), broilers (heightened risk), breeding chickens, growers and ratites.

Starting in 2019, RCs report their surveillance activities by month, allowing for more accurate description of the distribution of sampling events. A large proportion of the H5/H7 seropositive PEs was identified in April in Spain, among waterfowl game birds (44 seropositive PEs), associated with a

larger sampling effort in this category at the end of the hunting season. The seropositivity rate was also higher in February and March, especially in free-range laying hens.

Serological results for AI subtypes other than H5 and H7 were also reported for some PEs. However, due to the non-mandatory reporting, the results presented in this report do not represent the complete picture of the distribution of these subtypes in reporting countries.

Although an overall reduction in the proportion of H5/H7 seropositive establishments was noted in 2018 compared to 2017, this trend was not confirmed in 2019, with almost a doubling of the proportion. As observed since 2008, the number of H5 seropositive PEs detected remained higher than H7 detections. Establishments raising waterfowl made up a large proportion of H5/H7 seropositive establishments, as expected for these poultry categories. Backyard establishments were the category with the largest number tested and had the lowest proportion of seropositive establishments amongst those categories with at least one positive PE.

In Commission Delegated Regulation (EU) 2020/689[1], MSs are required from April 2021 to carry out complementary risk-based surveillance aiming to detect clusters of establishments (in time and geographical proximity) infected with LPAI viruses. The poultry categories in which this surveillance is recommended to be carried out include, among others, the categories where most of the serological positive results were found in 2019. In order to better understand the data resulting from this complementary surveillance (and poultry surveillance in general), RCs are encouraged to report the link between seropositive establishments, and the results of further sampling and/or testing carried out in the same or surrounding establishments. Finally, understanding the underlying poultry population will help to better understand the efficiency of the surveillance carried out at a European level. The estimated poultry population could be submitted to EFSA in an aggregated form (by poultry category and NUTS3 level) as a once-off exercise, with updates reported by RC when available.

Surveillance in wild birds

A total of 26 MSs, Iceland, Norway, Switzerland and the United Kingdom reported results from passive surveillance of AI in wild birds in 2019. Although not mandatory, some countries also reported results from their active surveillance programmes. Wild bird surveillance in some RCs is not based on representative sampling, and therefore, the results presented here cannot be extrapolated to the source populations. Comparisons are only valid for the specific observations recorded (surveillance samples) and cannot be used to imply differences between years, species or locations.

Results were reported for a total of 19,661 wild birds, including 8,926 (45%) sampled by passive surveillance. This is almost as many birds as in 2018, but less than in previous years. The total number of birds tested by passive surveillance by RC ranged from two birds in Iceland to 2,719 birds in Italy. As active surveillance results in wild birds are reported to EFSA on a non-mandatory basis, the numbers presented in this document do not represent the full extent of surveillance activities conducted by some RCs.

The distribution of number of birds by quarter was relatively consistent overall, but it varied when looking at specific countries. Almost all birds were fully identified with a species name (7,474 birds). These birds belonged to 244 species distributed in 22 orders. As expected, most samples originated from birds in the order Anseriformes (n = 2,169). The orders Passeriformes, Charadriiformes and Accipitriformes were also sampled in high numbers (n > 1,000). Forty-seven of the 50 species listed by EFSA as target for HPAI surveillance were sampled in 2019. The proportion of birds belonging to target species was 38% and 75% among passive and active surveillance samples, respectively.

A total of 933 wild birds tested positive to AI when considering all subtypes reported. This included only one bird testing positive for HPAI (H5N6 in this case), a common buzzard (*Buteo buteo*), found dead and submitted via passive surveillance in Denmark. The number of HPAI detections was notably lower than the 163 H5N6 HPAI-positive wild birds reported in 2018, despite a similar number of birds tested by passive surveillance in both years. The proportions of AI-positive birds in active and passive surveillance were 8% and 1%, respectively.

The 932 wild birds positive for non-HPAI viruses were reported by 16 of the 30 RCs: 84 birds testing positive for LPAI H5/H7 virus and 848 birds testing positive for strains other than H5/H7. A total of 21 wild bird species as well as birds from four genera with unknown species were detected as positive for non-HPAI AIV. Positivity rates were lowest in spring (mid-March to beginning of June). Most positive birds were detected around the month of September. The majority of positive LPAI detections were found by active surveillance (93%). Most LPAI-positive birds belonged to the order

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.084.01.0001.01.ENG

Anseriformes, which was expected given that this is the order most sampled by both active and passive surveillance.

A lower circulation rate of HPAI in wild birds in Europe in 2019 compared to 2018 is plausible, given the lower proportion of HPAI-positive wild birds identified in 2019 and assuming no major change in surveillance strategies occurred. Alternatively, the HPAI strains circulating in 2019 could have been causing less mortality in wild birds compared to previously circulating AIV. Nonetheless, it is important to note that the percentage of birds sampled by passive surveillance belonging to the list of target species recommended by EFSA is still very low (38%), as mentioned above. This list includes species that are more likely to die if infected with HPAI virus. Further research is recommended in order to provide a plausible list of wild bird species less likely to die if infected with HPAI to be sampled under active surveillance. Identifying specific areas outside and inside the EU, where active surveillance could take place at specific times of the year, is also recommended.

Last, this report also presents summary data of wild bird observations in the RCs by voluntary contributors, obtained from the EuroBirdPortal project. Despite the limitations of such data, and until further spatial modelling of the distribution and abundance of wild birds in Europe is readily available, the maps presented in this report could help to shed light on areas where the birds of the species belonging to the target list may gather, supporting RCs in carrying out more targeted surveillance activities. Further maps of the distribution of the 50 target species and the number of samples taken by RCs for those species by month and NUTS3 have been uploaded in Zenodo.[2] Considering the seasonality attached to the circulation of AIV, these maps may be of help in improving the timing of sampling within targeted surveillance activities.

[2] Monthly observations and samples from wild birds on the EFSA list of target species for 2019 by NUTS3 region. The green colour scale represents the number of wild bird observations from the target species, as per data provided by the EuroBirdPortal project. The black dots represent the number of wild bird samples from target species tested within the countries' AI passive surveillance programmes. Wild bird samples reported at NUTS2 level are not shown on these maps. https://zenodo.org/10.5281/zenodo.4290194

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1. Introduction

Avian influenza (AI) is a contagious disease that can affect all bird species. The infection is caused by Avian Influenza A viruses (AIV), which are classified into different antigenic subtypes based on their surface glycoproteins: haemagglutinin (H) and neuraminidase (N). To date, 16 H (H1–H16) and 9 N (N1–N9) glycoproteins have been identified in viruses isolated from avian hosts (Fouchier et al., 2005). AIV are also classified according to their pathogenicity into high pathogenic avian influenza (HPAI) viruses and low pathogenic avian influenza (LPAI) viruses.[3] Non-H5/H7 AIV subtypes usually cause mild disease when affecting poultry, while the pathogenicity of H5 and H7 virus subtypes varies, with LPAI viruses of these subtypes being able to mutate to HPAI viruses in poultry. HPAI infections spread rapidly and cause significant disease and mortality in many bird species, with epizootics of H5 HPAI virus having been reported in several countries in Asia, Africa, Europe and North America (EFSA AHAW Panel, 2017).

Wild birds of the orders Anseriformes and Charadriiformes are considered major reservoirs for LPAI viruses; during the last years, wild birds have been also implicated in the intercontinental spread of H5 HPAI viruses (The Global Consortium for H5N8 and Related Influenza Viruses 2016). Hence, wild birds are considered the main source of introduction of AIV infections in poultry in Europe (Central Veterinary Institute et al. 2017). To implement appropriate measures to prevent incursions, or to control the spread of the disease when incursions occur, Member States (MSs) have implemented surveillance programmes in poultry and wild birds, including serological and virological surveillance activities.

Below, a description of the legislative frame for the development and implementation of these surveillance programmes is presented. Also, the Terms of Reference of the European Commission mandate to the European Food Safety Authority (EFSA), related to the production of this report, are described.

1.1. Background and Terms of Reference as provided by the requestor

EU legislation on avian influenza requires Member States to carry out compulsory surveillance programmes in poultry and wild birds.

The objective of the surveillance programme for AI in poultry, as stated in Annex I of Commission Decision 2010/367/EU is:

> *to inform the competent authority of circulating avian influenza virus with a view to controlling the disease in accordance with Directive 2005/94/EC by the annual detection through active surveillance for:*
>
> *a - LPAI of subtypes H5 and H7 in gallinaceous birds (chickens, turkeys, guinea fowl, pheasants, partridges and quails) and ratites thereby complementing other existing early detection systems.*
>
> *b - LPAI of subtypes H5 and H7 and HPAI in domestic waterfowl (ducks, geese and mallards for re-stocking supplies of game).*

The objective of the surveillance programme for AI in wild birds, as stated in Annex II of Commission Decision 2010/367/EU is:

> *the timely detection of HPAI of the subtype H5N1 in wild birds in order to protect poultry in poultry holdings and safeguard veterinary public health.*

Also, as described in Decision 2018/1136/EU, the identification and review of areas that are at particular risk for the introduction of HPAI viruses into poultry establishments, should be carried out by MSs, ensuring that increased passive surveillance of the wild bird populations takes place in these higher risk areas.

Guidelines for the implementation of the surveillance programmes have been provided by the EC. The EC guidelines also include a list of wild bird target species which is under constant review as new evidence is generated when HPAI epidemics occur in Europe. As a result, EFSA published a scientific report providing further guidance to adjust wild bird surveillance of susceptible European species for the detection of H5 HPAI by passive surveillance (EFSA AHAW Panel, 2017).

Under Directive 2005/94/EC, MSs are requested to submit the results of these surveillance programmes to the competent authority. The EC has overseen the collection of the data from the MSs

[3] In the present report, LPAI-positive birds include both birds reported positive for an H5 or H7 AI virus not classified as HPAI and birds reported positive for subtypes other than H5 or H7.

surveillance activities up to, and including, data for 2019. Also, the former European Reference Laboratory for AI was tasked with the production of the annual surveillance report up to 2018, when the report describing the 2017 surveillance activities was produced (APHA 2017).

Late in 2017, EFSA received a mandate with the Terms of Reference being to: 'collect, collate, validate, analyse and summarise in an annual report the results from avian influenza surveillance carried out by Member States in poultry and wild birds'. In the context of Article 31 of Regulation (EC) No 178/2002, from 2019 onwards, EFSA was requested to provide the technical and scientific assistance to the Commission to deliver on this mandate. This implies that EFSA is in charge of producing the annual surveillance report on AI since 2019. In addition, the collation of all data relevant to the surveillance activities taking place in MSs has been conducted by EFSA since January 2019.

1.2. Interpretation of the Terms of Reference

One of the activities derived from the mandate described above was the production of the AI annual surveillance report. This document represents the second[4] annual surveillance report on AI generated by EFSA. The data submitted by MSs to EFSA, compiling the results of the surveillance activities performed in poultry and wild birds in 2019, are summarised. These data were collected and recorded at an MS level following the directives mentioned in Section 1.1, and subsequently reported to EFSA. In this report, the results of the poultry and wild bird serological surveillance programmes are presented and discussed. A brief description of the surveillance methods and the reporting framework is also provided.

2. Methods

2.1. Framework for reporting

Directive 2005/94/EC on Community measures to control avian influenza established in its Article 4 the legal basis for the obligatory conduct of surveillance programmes in poultry and wild bird populations. Both surveillance programmes must be carried out following harmonised guidelines which were laid down in the Commission Decision 2010/367/EU.

Surveillance programmes of the MSs are evaluated and approved for co-financing by Commission's procedures that are detailed on the Commission's website: http://ec.europa.eu/dgs/health_food-safety/funding/cff/animal_health/vet_progs_en.htm.

Diagnostic procedures for testing the samples collected within the surveillance programmes are outlined in Diagnostic Manual for avian influenza as set out in Decision 2006/437/EC[5].

Previous Annual Reports and more information on surveillance for avian influenza in poultry and wild birds can be found at: http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/ eu_resp_surveillance_en.htm.

2.2. Survey design

2.2.1. Poultry

The epidemiological unit for reporting surveillance in poultry is the holding, which is defined in Council Directive 2009/158/EC[6] as: 'a facility used for the rearing or keeping of breeding or productive poultry. For the purposes of avian influenza surveillance, this may include facilities that only contain poultry during certain months of the year (i.e. poultry do not need to be present all year round)'. In this report, the word 'holding' was replaced by 'poultry establishment'[7] to be aligned with the Regulation (EU) 2016/429 (Animal Health Law). Detailed guidelines for the design of surveillance

[4] The previous annual report on surveillance for avian influenza in poultry and wild birds is available online: https://www.efsa.europa.eu/fr/efsajournal/pub/5945

[5] Commission Decision 2006/437/EC of 4 August 2006 approving a Diagnostic Manual for avian influenza as provided for in Council Directive 2005/94/EC. OJ L 237, 31.8.2006, p.1–27.

[6] Council Directive 2009/158/EC of 30 November 2009 on animal health conditions governing intra-Community trade in, and imports from third countries of, poultry and hatching eggs. OJ L 343, 22.12.2009, p. 74–113.

[7] 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.

based on representative sampling or risk-based surveillance as well as the identification of the target population (poultry species and production categories) and guidelines for calculation of sample size at holding and bird level are described in Annex I of the Commission Decision 2010/367/EU.

2.2.2. Wild birds

The epidemiological unit for surveillance in wild birds is the bird. Procedures for surveillance design are outlined in Annex II of the Commission Decision 2010/367/EU.

2.3. Sampling procedures and laboratory testing

Sampling and laboratory testing procedures for both poultry and wild birds are described in Annex I and II, respectively, of Commission Decision 2010/367/EU. In this Commission Decision, the procedures to carry out epidemiological investigations following positive detections are also outlined.

Following the events of previous years (2014–2017), when HPAI virus with N subtype other than N1 was detected in poultry and wild birds, it was expected, particularly in the case of wild bird samples, that MSs would proceed to identify the specific N subtype, either by using national reference laboratories or submitting the samples to the EU reference laboratory for its identification. In contrast, the only HPAI subtype identified in wild birds in 2018 and 2019 was H5N6.

The definition of Low Pathogenic Avian Influenza (LPAI) provided by Annex I of Directive 2005/94/CE includes any H5 or H7 AI virus not classified as HPAI, and excludes all other subtypes of Influenza A viruses. For the purpose of the present report, and for consistency with the previous report, birds reported positive for subtypes other than H5/H7 and not classified as HPAI are also included as LPAI.

2.4. Data and data processing

Data collation and validation as well as exploratory and statistical analysis were carried out using the statistical software R (R Core Team, 2020).

In some RCs, establishments were sampled several times throughout the year, this was the case for establishments containing one or different poultry categories. For the purpose of this report, each sampling exercise taking place on a specific date, at a specific establishment and targeting a specific poultry category was considered as an independent event and counted as an establishment sampled. As a result, for some countries, the total number of samplings may be higher than the total number of establishments of a specific poultry category. Therefore, the numbers reported in this manuscript as poultry establishments (PEs) sampled should be interpreted as the number of sampling events taking place in an RC for each of the reported categories.

For the wild bird data analysis, data submitted by RCs as the year of sampling' ('sampY'), month of sampling ('sampM') and day of sampling ('sampD') were used as sampling date. As for the 2018 report, the updated EFSA list of target species (EFSA, 2017) was used instead of the target list provided in the Commission Decision 2010/367/EU. Pooled testing takes place in some MSs when more than one wild bird from the same species are collected at the same time and location (as indicated by variable 'sampMethod'). In such cases, the variable 'sampSize' was used to report the number of birds from which samples were pooled. When positive results were obtained from pooled samples (this occurred with pools of up to five birds), all the birds included in the pool were considered positive, given that no further information was available.[8]

Eurostat reference shapefiles were used to create the maps: 'Countries 2016' (version 03/06/2019) and 'NUTS 2016' (version 14/03/2019). These versions were used to match the units reported in the surveillance data for 2019, as the next versions ('Countries 2020' and 'NUTS 2021') were released in 2020, after the data collection for the present report. Maps plotting the geographical distribution of the sampling events and the location of positive results were aggregated at NUTS2 level for both poultry and wild birds in the present report. However, maps at NUTS3 level are also provided as high-quality images on the EFSA website, for countries which provided data at NUTS3 level. To summarise sampling activities, the intensity of sampling, calculated as the number of samples taken within a NUTS2 region per 100 km^2, was displayed, given that the total number of poultry establishments present in a given region was not available. Samples with geocoordinates which could not be matched

[8] This assumption very likely resulted in an over-estimation of the bird-level prevalence of LPAI. To address this issue, either samples in positive pools should be re-tested individually, or, if available, more detailed data on pooling strategies and results could be used for statistical estimation of bird-level prevalence using a tool such as EpiTools (https://epitools.ausvet.com.au/pooledprevalence).

to an NUTS region from the country reporting the data are not displayed in the maps, but are accounted for by all other figures and tables in the document.

The results presented in this report are based on the data reported by RCs under Commission Decision 2010/367/EU. As a result, data may differ, particularly with regard to HPAI detections in wild birds, from data reported to the Animal Disease Notification System (ADNS), the World Animal Health Information Database (WAHID) or individual national surveillance databases.

Last, the data set used for analysis contained some data reported for the last trimester in 2018, which had not been submitted by the time the 2018 report was complete. These data are not reported in the present document, which only summarises 2019 data. The links to the data sets provided by the RCs can be found in Appendix G (Table G.1).

This scientific report was shared with MS representatives and AHAW Panel, with the comments received from both groups being addressed prior to its publication.

3. Results

3.1. Poultry

3.1.1. Number of poultry establishments sampled

Twenty-seven MSs as well as Iceland, Norway, Switzerland and the United Kingdom,[9] here referred to as reporting countries (RCs), reported their serological surveillance activities in 2019. Data on the total number of poultry establishments present in each RC and on the distribution of poultry categories within RCs were not available for this report. For this reason, the number of samples by poultry category reported below does not include information on the proportion of the population sampled in each RC and poultry category.

A total of 24,419 poultry establishments (PEs) were sampled as part of the RCs' surveillance programmes. In this report, the numbers reported as 'PEs sampled' should be treated with caution as they refer to the total number of poultry sampling events taking place on a specific date, in a specific establishment and for a specific poultry category (see Methods Section 2.4 for further details). Thus, the number of distinct poultry establishments where sampling occurred in each country may be lower than the total number of PEs sampled reported here, where poultry establishments have been sampled more than once in 2019. The reason PEs are defined in this way is because not all RCs submit surveillance data in a non-aggregated manner.

Surveillance in RCs varied in both the number of PEs sampled and the poultry categories targeted for surveillance (Figure 1). For instance, in terms of the most sampled poultry categories per RC, Italy targeted mainly fattening turkeys and backyard flocks, as well as growers[10] and laying hens, while the sampling in the Netherlands was mostly distributed between free-range and conventional laying hens, broilers (heightened risk) and breeding chickens. In France, the category with the largest number of samples was fattening ducks. Countries such as Croatia, Cyprus, Hungary, Latvia, Romania and Slovenia mostly sampled backyard flocks. An overview of the total number of PEs sampled by each RC and for each poultry category is provided in Figures 5A and 9A, respectively.

When looking at the poultry categories among which the largest number of samples was taken by RCs, backyard flocks and conventional and free-range laying hens were the three most sampled poultry categories (Figure 1).

In addition, Figure 1 also shows the poultry categories which are most frequently targeted (i.e. tested by the largest number of RCs). These categories were laying hens (conventional and free-range), fattening turkeys, breeding chickens and gallinaceous game birds, for which surveillance results were reported by most of the 31 RCs (27, 22, 24, 24 and 23 countries, respectively). By contrast, only three and nine countries reported taking samples from growers and breeding geese, respectively. Between 11 and 16 countries reported surveillance results for the remaining categories (others, breeding and fattening ducks, breeding turkeys, backyard flocks, waterfowl game birds, ratites, broilers at heightened risk and fattening geese).

[9] Although not a MS at the time the report was written, it was an MS when the 2019 data were submitted to EFSA.

[10] For the purpose of this report, growers are defined as poultry establishments (different species) in which birds are reared for only part of their productive cycle, to be then sold to other farms belonging to the rural sector where birds will end their production cycle for meat/eggs (Brouwer et al., 2018).

The mapping between current, more detailed reporting categories and the 16 reporting categories used in this report (for consistency with previous reports) is presented in Appendix A (Tables A.1 and A.2).

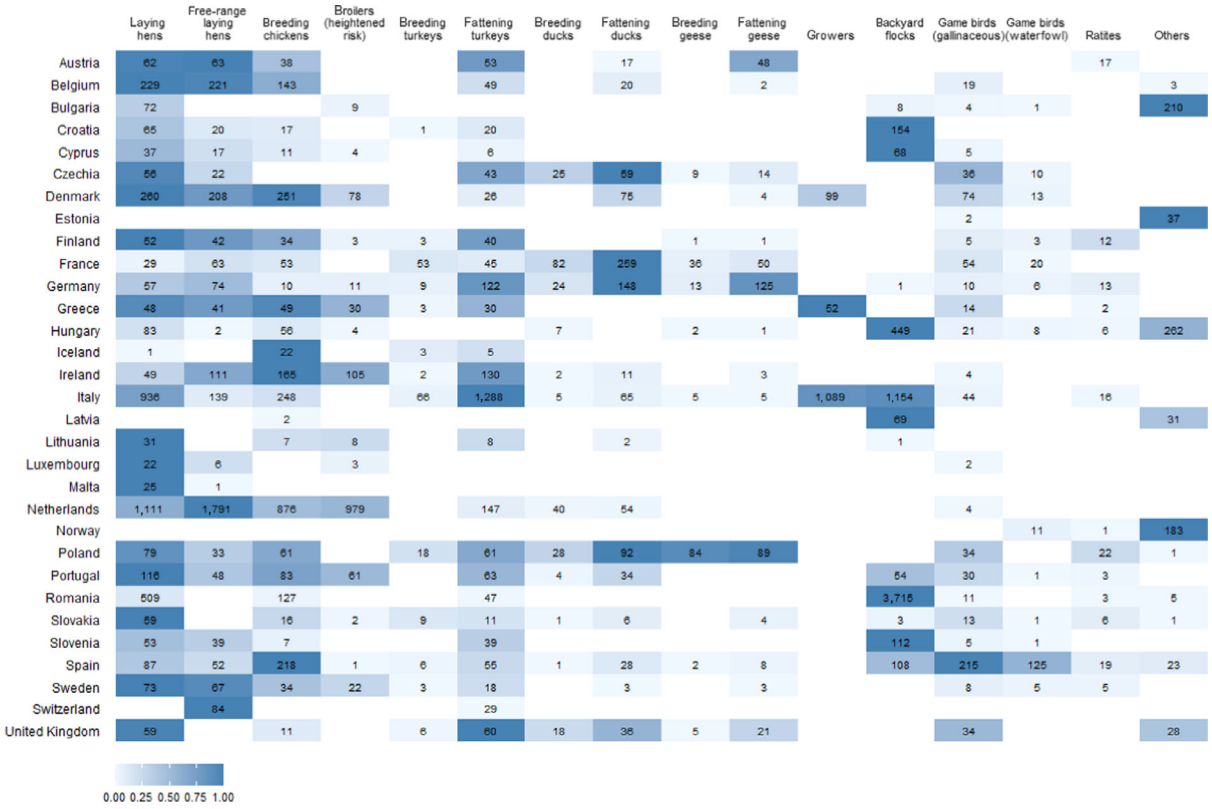

Figure 1: Total number of PEs sampled, presented by RC and poultry category, according to 16 poultry categories. A scale of blue (going from darker to lighter blue colours) is used to highlight poultry categories with the largest number of PEs sampled per RC

Within MSs and in addition to the sampling carried out under European funding ('EU co-funded active surveillance', in blue in Figure 2), five countries reported surveillance results from their national programme (Hungary, Lithuania, Luxembourg, Slovakia and Spain) and two from an industry programme (Hungary and Slovakia) (Figure 2). Norway, Switzerland and Iceland reported results from their national programmes, with Iceland also reporting some results obtained via private industry sampling. In all MSs, the reported number of PEs sampled under European funding was larger than the number of samples reported for national or industry programmes.

Note that it is not mandatory for MSs to report results from surveillance activities other than the EU co-funded active surveillance.

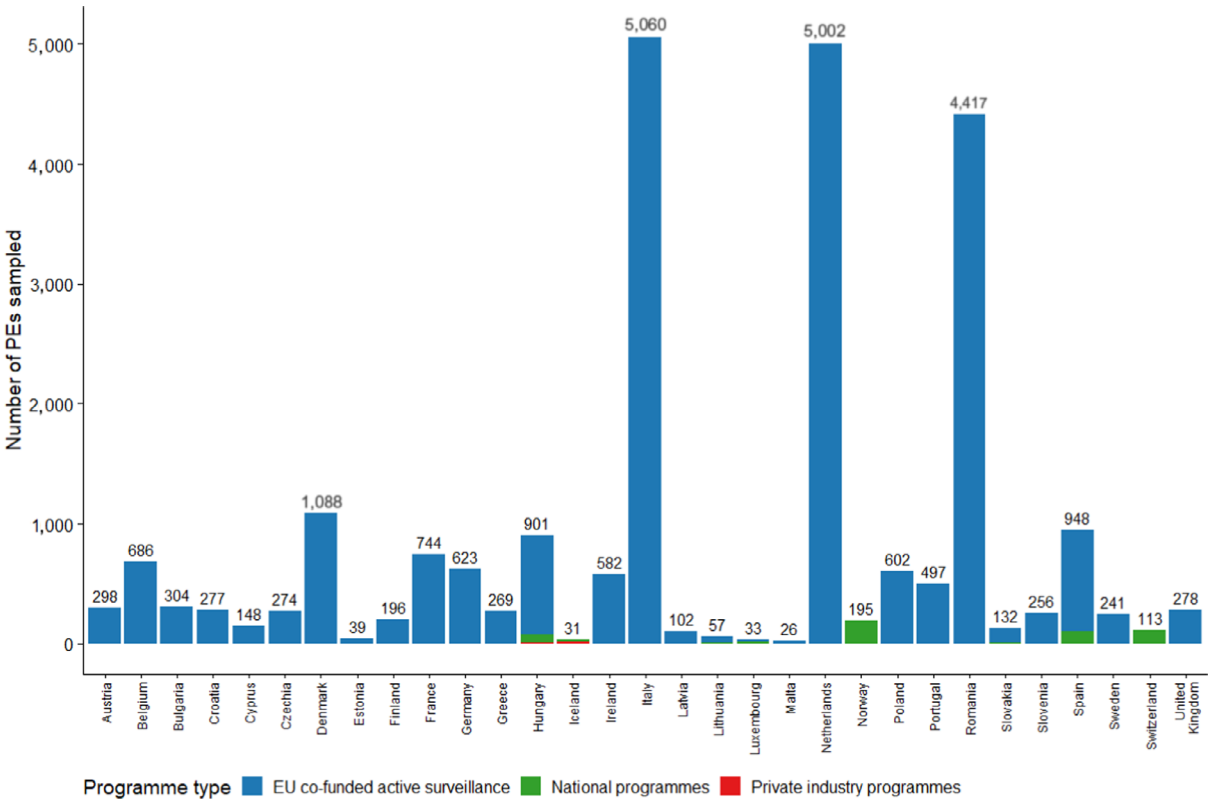

Figure 2: Number of PEs sampled by RCs in 2019 according to the type of surveillance programme and for which results were reported to EFSA

3.1.2. Timing of sampling in poultry

In terms of the timing of the sampling, 59% of the sampling took place in the second half of the year (July–December), with two countries reporting data from only this period due to technical reasons (France and Germany, Figure 3). A total of 14,362 PEs were reported as sampled from July to December 2019, while 10,057 PEs were reported as sampled in the reporting period going from January to June. Figure 3 shows the monthly distribution of poultry sampling in each RC.

Figure 3: Monthly number of PEs sampled in 2019, presented by RC. Note that the scale of the vertical axes is specific to each country

3.1.3. Avian influenza in poultry

3.1.3.1. Serological results overview

In this section, comparisons of seropositivity rates between different groups relate to the surveillance results. They cannot be extrapolated to the source populations because:

- the sampling was targeted at higher risk groups (non-representative sampling strategy) in some RCs,
- the targeting approaches may differ between countries, between groups and between years.

Thus, the percentages and trends provided in this report relate only to the surveillance samples, not to the underlying population. Temporal trends are based on the assumption that sampling strategies and targeting remain constant over time.

In 2019, 87 PEs tested positive for AI H5 and 22 for H7 (Figure 4). The combined H5/H7 seropositive percentage was 0.45%, 1.9 times higher than the seropositive percentage in 2018 (0.24%). The percentage of AI H5 seropositive PE was 0.36%. This number is higher than that of the previous year (0.23%), but equal to the percentage of H5 positives found in 2017 (0.36%). The percentage of AI H7 seropositive PEs was 0.09%, higher than the proportion found in 2018 (0.01%). In 2019, the total number of PEs sampled (n = 24,419) was at its highest since 2014. It was lower than the number of PEs sampled in 2013 and in previous years. The downward trend in the number of PEs sampled observed since 2008 may be reverting (Figure 4A).

One PE in Denmark was found positive for both H5 and H7. Eight positive samples were reported for this specific PE, including seven which were characterised as H5 and only one sample was identified as H7. Therefore, the PE was classified as H5-positive for the purpose of this analysis.

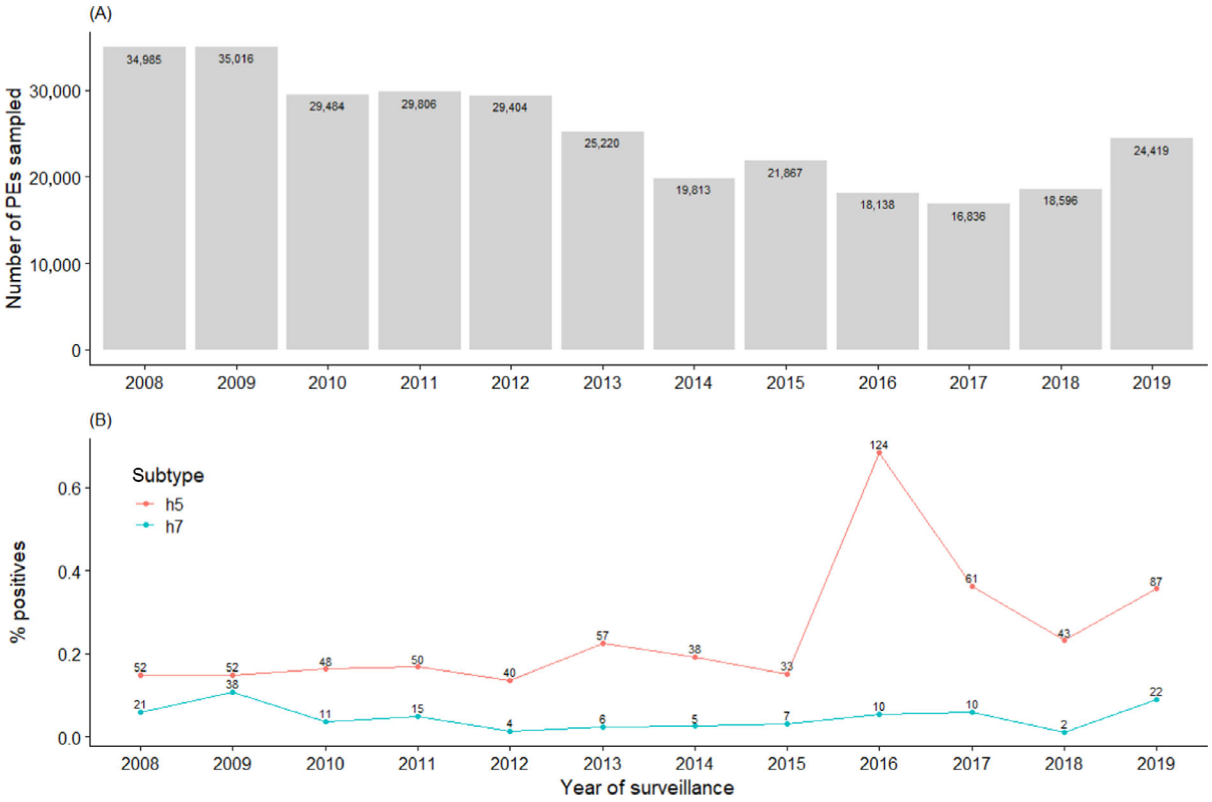

Figure 4: (A) Total number of PEs sampled per year, (n = 24,419), and (B) line graph of the percentage of the AI seropositive PEs of the H5 and H7 subtypes, with the number of seropositive PEs shown per year as labels (n = 109)

3.1.3.2. Serological results by reporting countries

Considerable variation in the number of PEs sampled among RCs was observed in 2019, as already noted in the previous report[11] and shown here in Figure 5. This was also the case among regions within each RC (Figure 6). The total number of PEs sampled among RCs ranged from 26 in Malta, to 5,060 in Italy, with the median number of PEs sampled among RC being 277 (Figure 5). Variation among RCs in terms of the number of PEs testing seropositive to either H5 or H7 AI was also noticed. Nine RCs reported the detection of seropositive PEs for H5 or H7. All nine countries reported detection of AI H5 (total of 87 PEs). Three RCs, the Netherlands, Denmark and Spain, reported the detection of AI H7 seropositive PEs (total of 22 PEs) (Figure 5). Interestingly, all H5/H7 detections occurred in countries which sampled a number of PEs larger than the median number of PEs sampled.

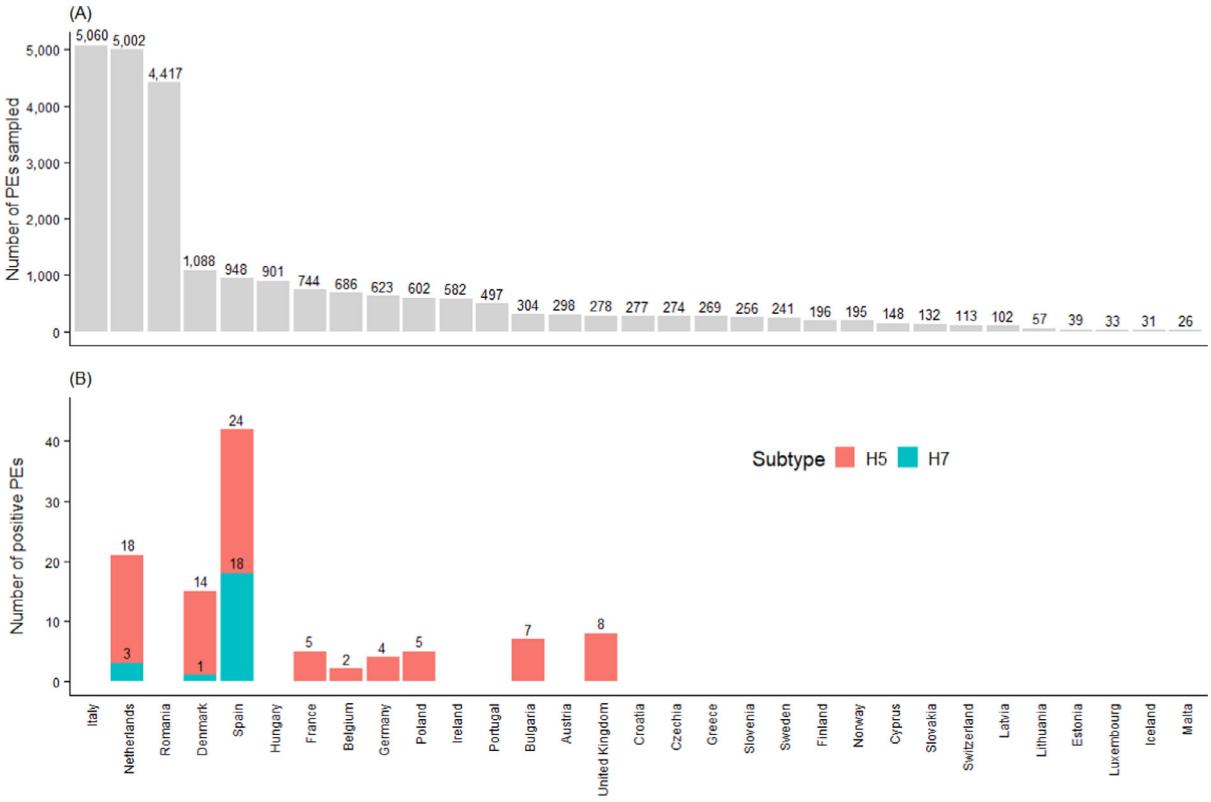

Figure 5: (A) Total number of PEs sampled in 2019 per RC shown in descending order (n = 24,419), and (B) total number of serologically positive PEs found by H subtype (n = 109)

3.1.3.3. Serological results by administrative units

Surveillance activities in poultry were reported for 58 NUTS2 (Nomenclature of Territorial Units for Statistics, level 2) units and 601 NUTS3 units in 2019. Most of the reporting at NUTS2 level was linked to surveillance activities in Belgium, Germany and Italy. A few PEs were also reported at NUTS2 level by the United Kingdom. Out of the 24,419 PEs, 6,377 and 18,042 were reported at NUTS2 and NUTS3 level, respectively. Out of 109 seropositive PEs, 8 and 101 were reported at NUTS2 and NUTS3 level, respectively.

Figure 6 shows the geographical distribution of the surveillance activities that took place in 2019, as well as the number of H5 or H7 seropositive detections. Data are represented at the NUTS level they were reported at (i.e. the maps show a combination of NUTS2 and NUTS3 units). The sampling density, estimated as the number of PEs sampled per 100 km^2 within an NUTS region, and the distribution of the seropositive PEs for AI H5 or H7 is presented in the upper and lower maps, respectively.

[11] https://www.efsa.europa.eu/fr/efsajournal/pub/5945

Five PEs sampled in Germany, including two positive PEs, were recorded in extra-regio[12] NUTS2 'DEZZ', which is not visible on the maps below.

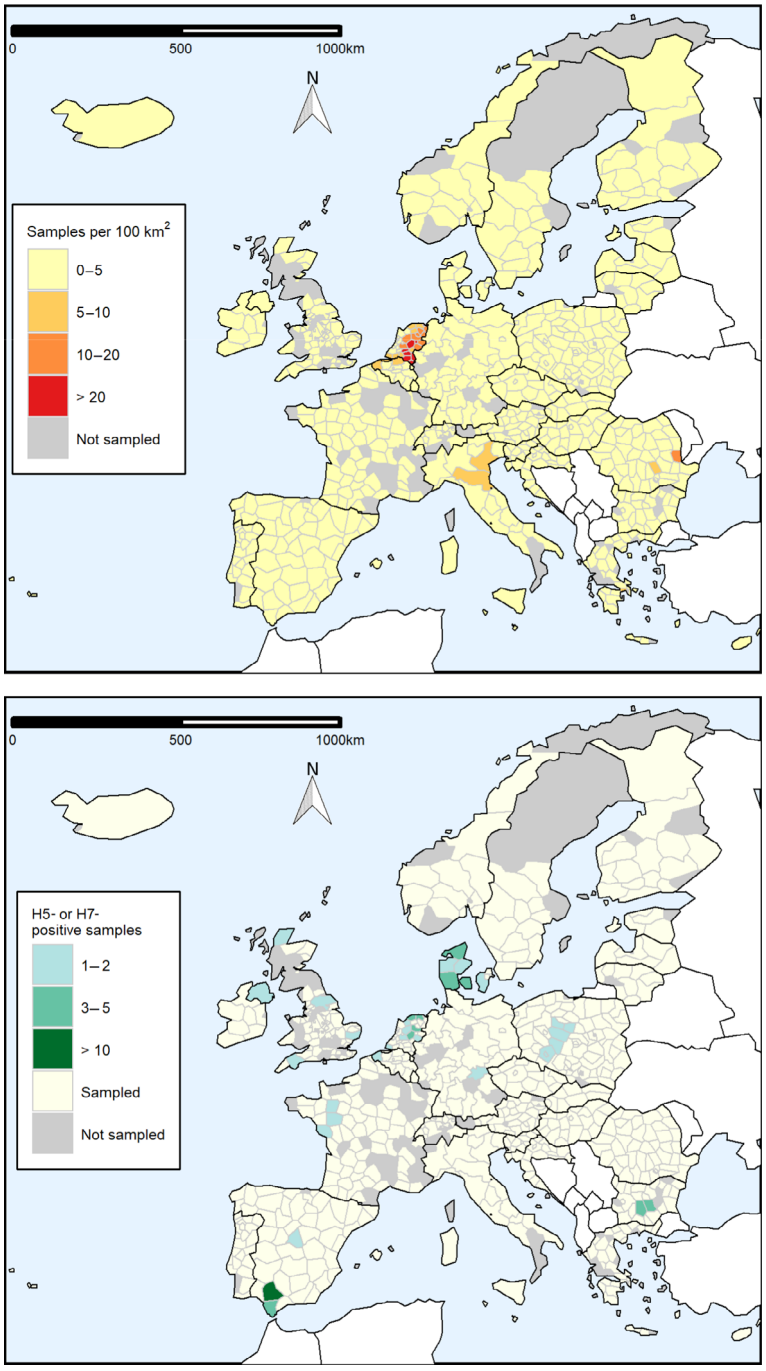

Figure 6: Sampling density expressed as the number of PEs sampled per 100 km^2 (upper map) and geographical distribution of AI H5 and H7 seropositive PEs (lower map) by administrative unit. Non-reporting countries are shown in white

3.1.3.4. Serological results by month

Since 2019, poultry surveillance data have been reported on a monthly basis. The distribution of PEs testing positive for H5 or H7 by month shows that the 2 months with the highest seropositivity

[12] An *extra-regio* territory is made up of parts of the national economic territory which cannot be attached directly to a single region that is part of the national geographic territory (such as air-space, territorial waters and the continental shelf, embassies, consulates, military bases and deposits of oil or natural gas in international waters).

rates (and the highest number of seropositive PEs) were March and April 2019 (Figure 7). During these months, 13 and 44 PEs, respectively, were reported positive (compared to one to nine PEs during other months of the year). It is important to note that the highest seropositivity rates did not coincide with the months where poultry sampling was most intensive (September–November). However, April was the month where most PEs from the category 'game birds (waterfowl)' were sampled (115 PEs sampled in April compared to 90 during the remaining 11 months). Out of 42 positive PEs in waterfowl game birds, 40 were identified in April, and one each in March and September.

In March, two-thirds of the positive events were identified in free-range laying hens. The sampling was relatively consistent throughout the year in this category and the seropositivity rates were highest (above 2%) in February and March.

For the nine countries reporting H5 or H7 seropositive PEs, the distribution of these events by month is shown in Figure 8.

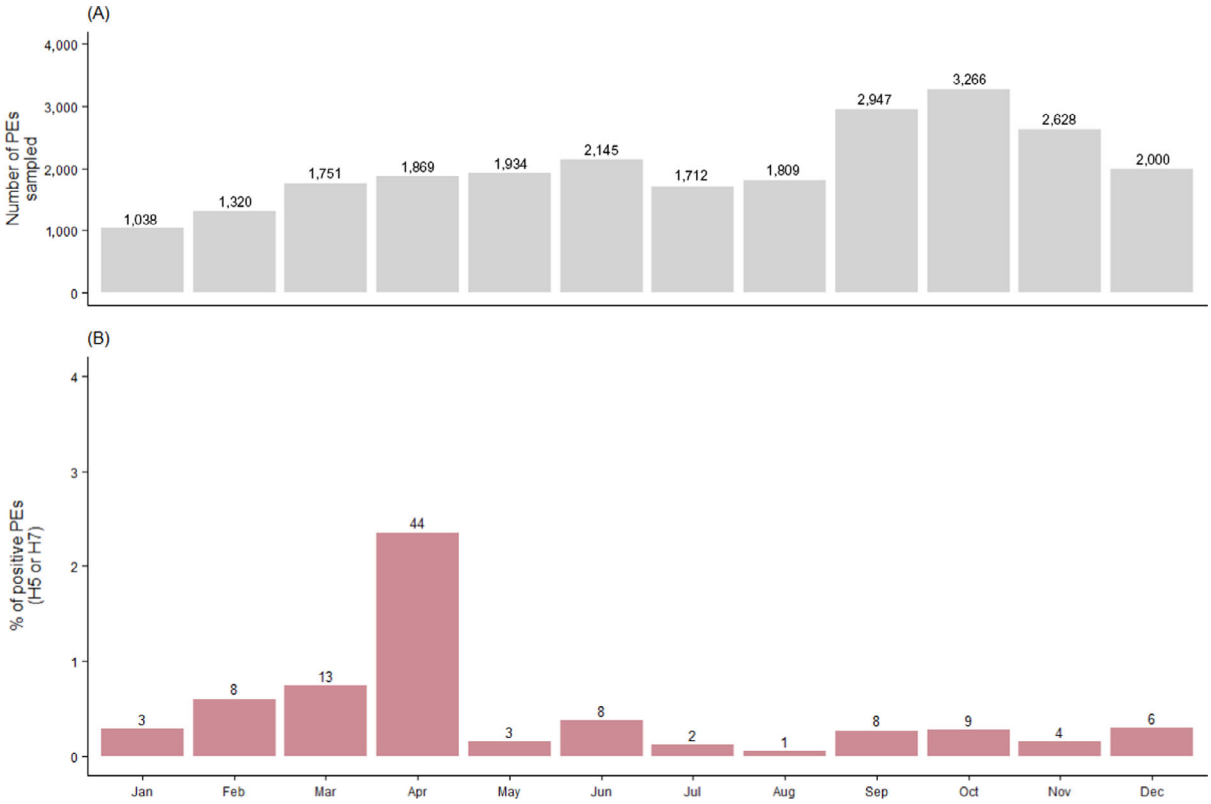

Figure 7: (A) Total number of PEs sampled by month with values above the bars referring to the number of PEs sampled, (n = 24,419). (B) percentage (*y*-axis) and number (above bars) of PEs sampled that tested serologically positive to H5 or H7 AI virus by month (n = 109)

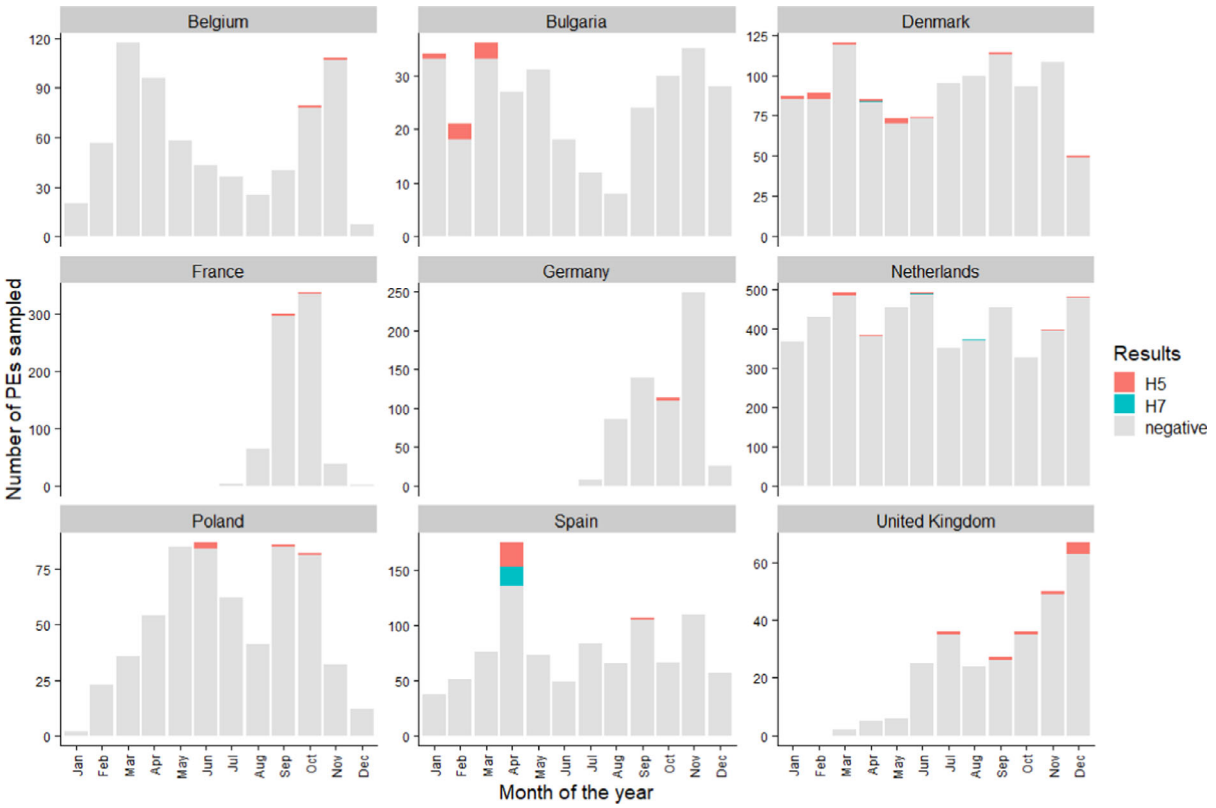

Figure 8: Monthly number of PEs sampled and positive in serology (H5 or H7 only) in 2019, presented for RCs with at least one H5- or H7-positive PE only. Note that the scale of the vertical axes is specific to each country

3.1.3.5. Serological results by poultry category

The highest number of PEs sampled by RCs in 2019 was from the backyard category (n = 5,896), with the second largest number being conventional laying hen PEs (n = 4,260) (Figure 9A). These two most sampled categories were the same as in 2018, except that conventional laying hens ranked first in 2018. In comparison to the previous year, sampling from backyard PEs had doubled in 2019. Other categories sampled in large numbers were the free-range laying hens, breeding chickens and fattening turkeys (Figure 9A).

As in 2018, the highest percentage of AI H5 or H7 seropositive PEs in 2019 was found in the waterfowl game bird category (20.5% out of 205 waterfowl game bird PEs sampled), followed by breeding geese (5.1% out of 157 PEs sampled) and others (1.4% out of 784 PEs sampled). The proportion of seropositive PEs was under 1% in all other poultry categories. When considering only gallinaceous species, the highest percentage of H5 or H7 seropositive PEs was observed in the free-range laying hen category (0.9% out of 3,144 PEs sampled). A high proportion of H5- or H7-positive PEs was also reported in the 'others' category (1.4%, n = 784). In 2019, no H5 or H7 seropositive results were found in turkeys (fattening or breeding), broilers (heightened risk), breeding chickens, growers and ratite categories. The same results were observed for these categories in 2018.

In addition to H5- and H7-positive results, nine RCs reported non-H5/H7-positive results in poultry (Austria, Belgium, Denmark, Estonia, Germany, Latvia, Norway, Sweden and Spain). There were 313 PEs seropositive for AI virus strains other than H5 or H7.[13] The categories with the largest numbers of non-H5/H7 seropositive PEs were the laying hens (free-range and conventional), waterfowl game birds, breeding chickens and others. Proportions of non-H5/H7 seropositive PEs by poultry category could not be estimated, as not all RCs reported these results. For this reason, Figure 9 does not display the non-H5/H7 results.

For each poultry category, detailed results by month are shown in Figure 10. In addition, surveillance results by bird species and order are shown in Figure B.1 – Appendix B. The figure shows

[13] Reporting of non-H5 or H7 seropositive PEs by MSs is not compulsory.

that, regardless of management system, positive PEs were found in geese, domestic and mallard ducks, chickens and pheasants. A large number of positive samples were identified in PEs raising game birds from the order Anseriformes for which the bird species was not available.

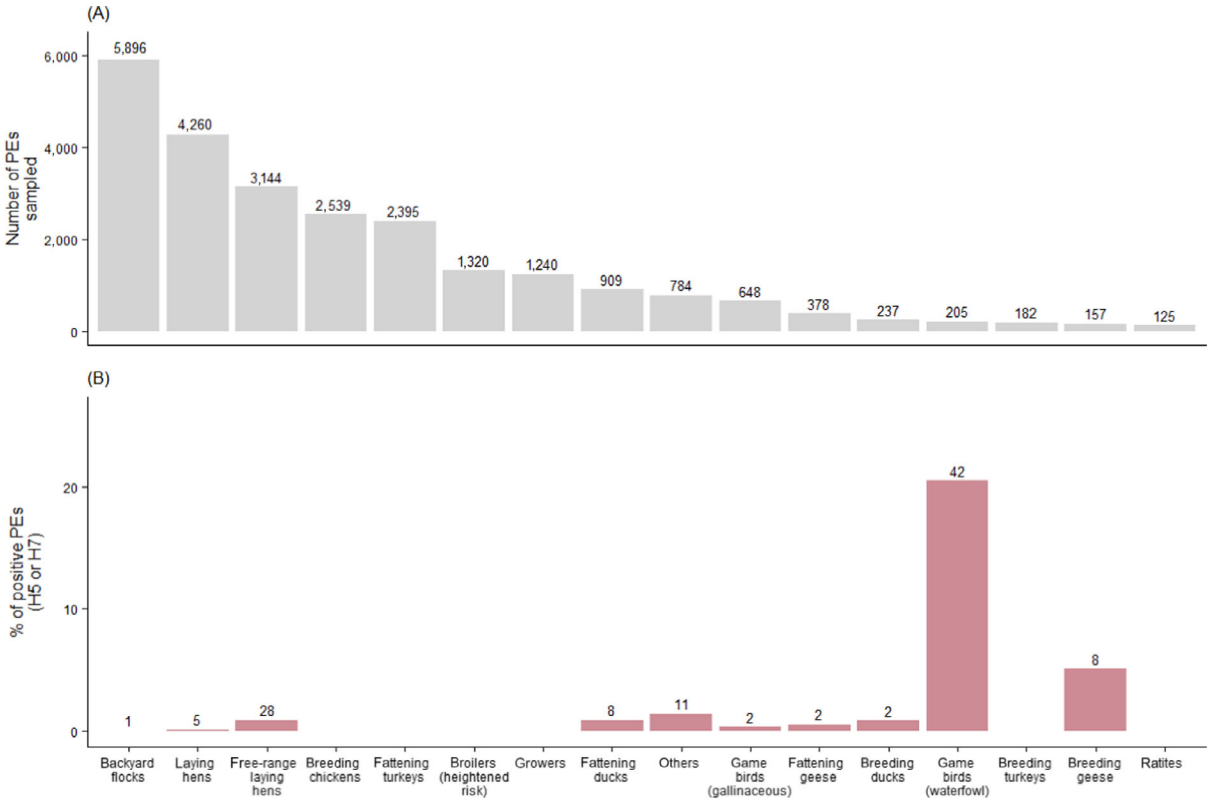

Figure 9: (A) Total number of PEs sampled by poultry category with values above the bars referring to the number of PEs sampled (n = 24,419); (B) percentage (y-axis) and number (above bars) of PEs sampled that tested serologically positive to H5 or H7 AI virus by poultry category (n = 109)

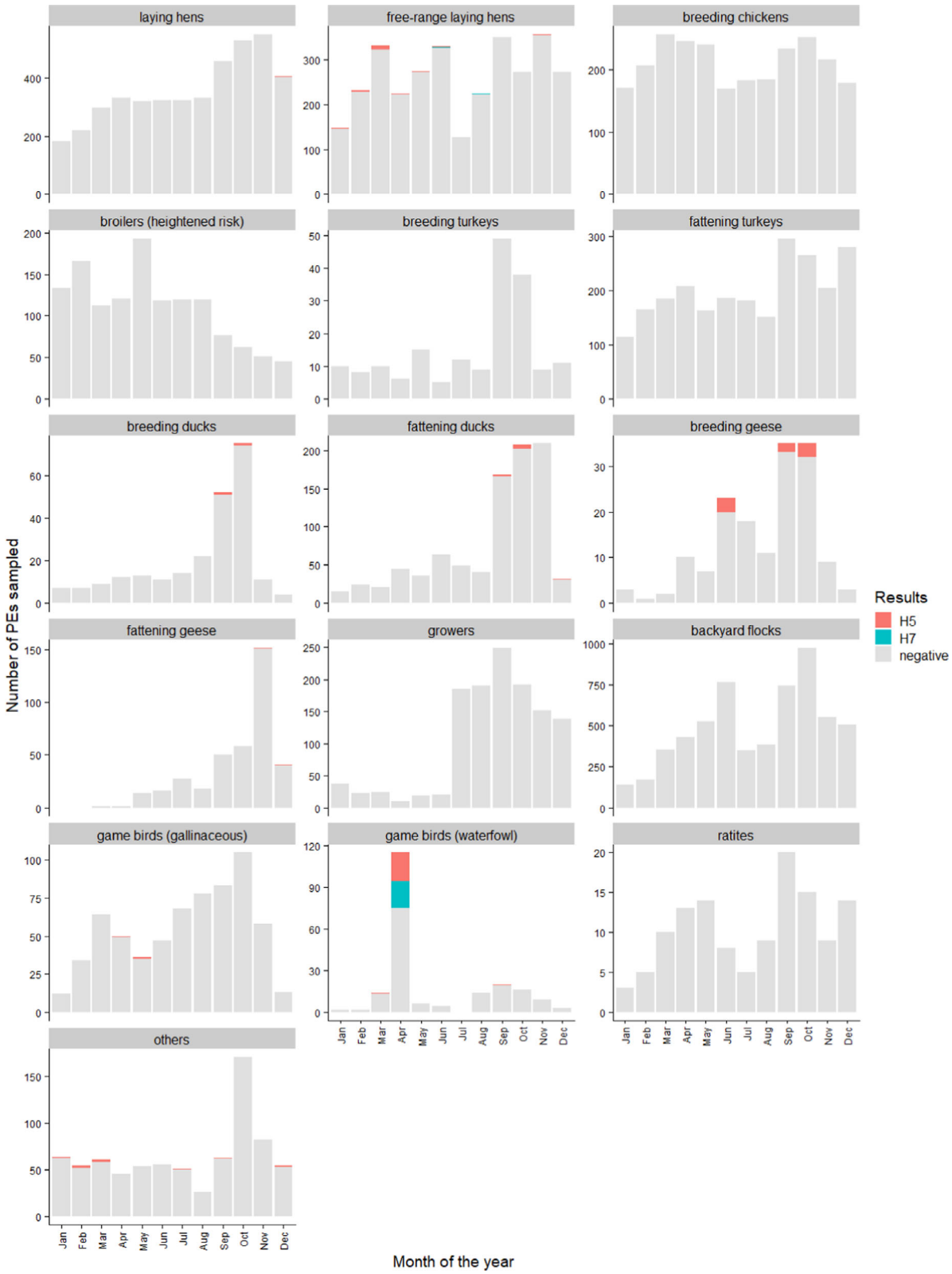

Figure 10: Monthly number of PEs sampled and positive in serology (H5 or H7 only) in 2019, presented by poultry category. Note that the scale of the vertical axes is specific to each category

3.1.3.6. Serological results: summary

Figure 11 shows the countries and poultry categories in which H5 seropositive birds were detected. Spain, the Netherlands and Denmark were the countries reporting the most H5-positive PEs. Those seropositive PEs were reported mainly in laying hens (conventional and free-range) in Denmark and the Netherlands, and mainly in waterfowl game birds in Spain.

Three RCs reported the detection of H7 seropositive PEs: 18 waterfowl game bird PEs in Spain, 3 free-range laying hen PEs in the Netherlands and 1 waterfowl game bird PE in Denmark.

The sensitivity of serological surveillance activities to detect HPAI in RCs depends on several parameters, including the number of poultry establishments in each country, the number of establishments sampled, the sensitivity of within-establishment sampling and the design prevalence (proportion of establishments which is expected to be infected should HPAI be present in the country).

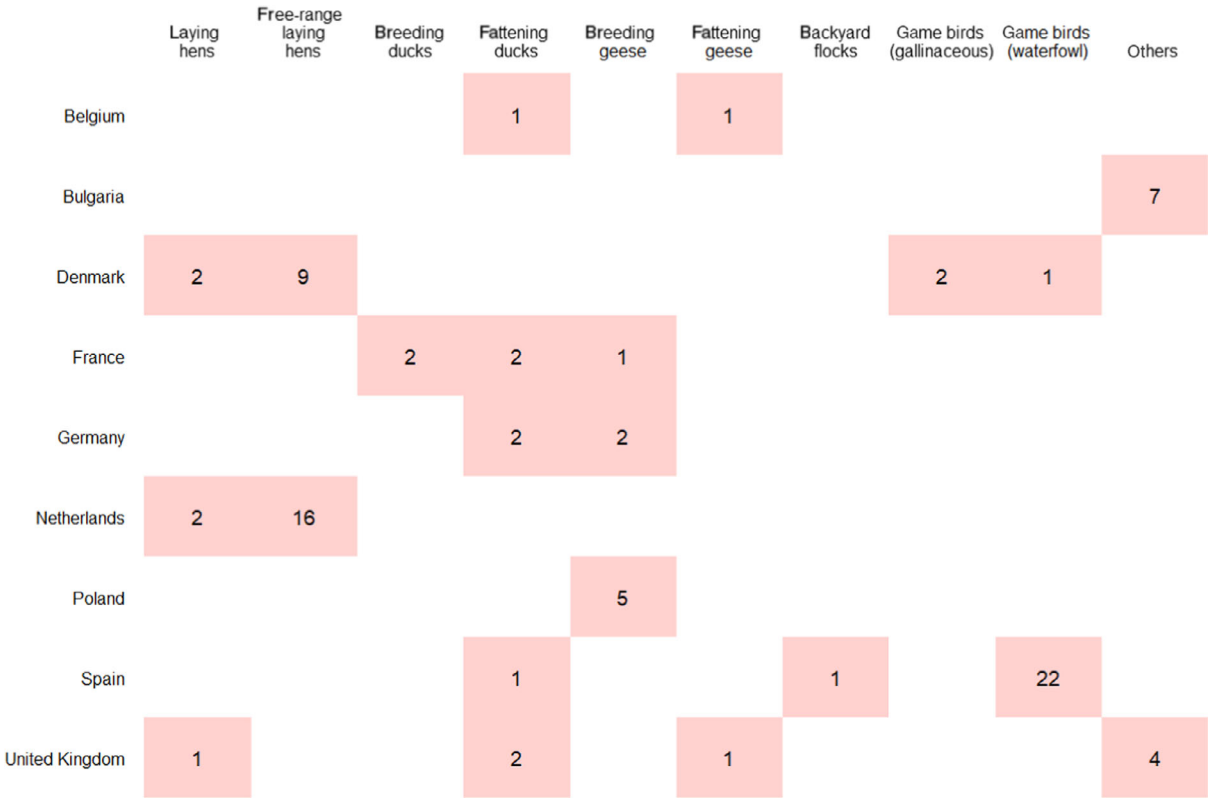

Figure 11: Number of H5-positive PEs by RC and poultry category in 2019, presented for RCs and categories with at least one H5-positive PE only (n = 87)

3.1.3.7. PCR and virological results

Out of the 109 PEs with positive serological tests for H5 or H7, samples from 80 PEs were tested for AI viral RNA using polymerase chain reaction (PCR). Four of these PEs tested positive in PCR:

- one in France positive for a non-H5/H7 virus for which pathogenicity results were not available;
- two positive in Denmark, one for H5N1 LPAI (free-range laying hens) and one for H7N7 LPAI (game-purpose mallards). These PEs were also positive in virus isolation;
- one in the Netherlands positive for a non-H5/H7 virus for which pathogenicity results were not available.

Most of the 80 seropositive PEs were tested by PCR on the same day (n = 57), while the remainder were resampled for PCR testing on average 6 days after the serological tests.

In addition, 12 countries also reported PCR results from 653 PEs carried out either as the screening test or subsequent to a negative serological test result. Five of these PEs were found positive for AI viral RNA: four H5N8 HPAI in Bulgaria and one H7N3 LPAI in Italy.

AI virus was subsequently isolated from samples collected in the two seropositive PEs testing positive by PCR in Denmark. No virus isolation results were available for the other PEs with positive

serological tests. Virus isolation results were available for samples from three PEs (all in Spain) and were all negative.

3.2. Wild birds

3.2.1. Number of birds sampled

In 2019, a total of 19,661 wild birds were sampled by 26 MSs as well as Iceland, Norway, Switzerland and the United Kingdom (RCs) either by active or passive surveillance. Malta did not report wild bird surveillance results for 2019.

Within MSs and in addition to the sampling carried out under European funding ('EU co-funded passive surveillance', in blue in Figure 12), four countries reported surveillance results from their national programme (Belgium, Germany and Spain) or from an industry programme (Hungary). Norway, Switzerland and Iceland reported results from their national programmes. In Belgium, Germany and Spain, the reported number of birds sampled under the national programme was larger than those sampled under European funding.

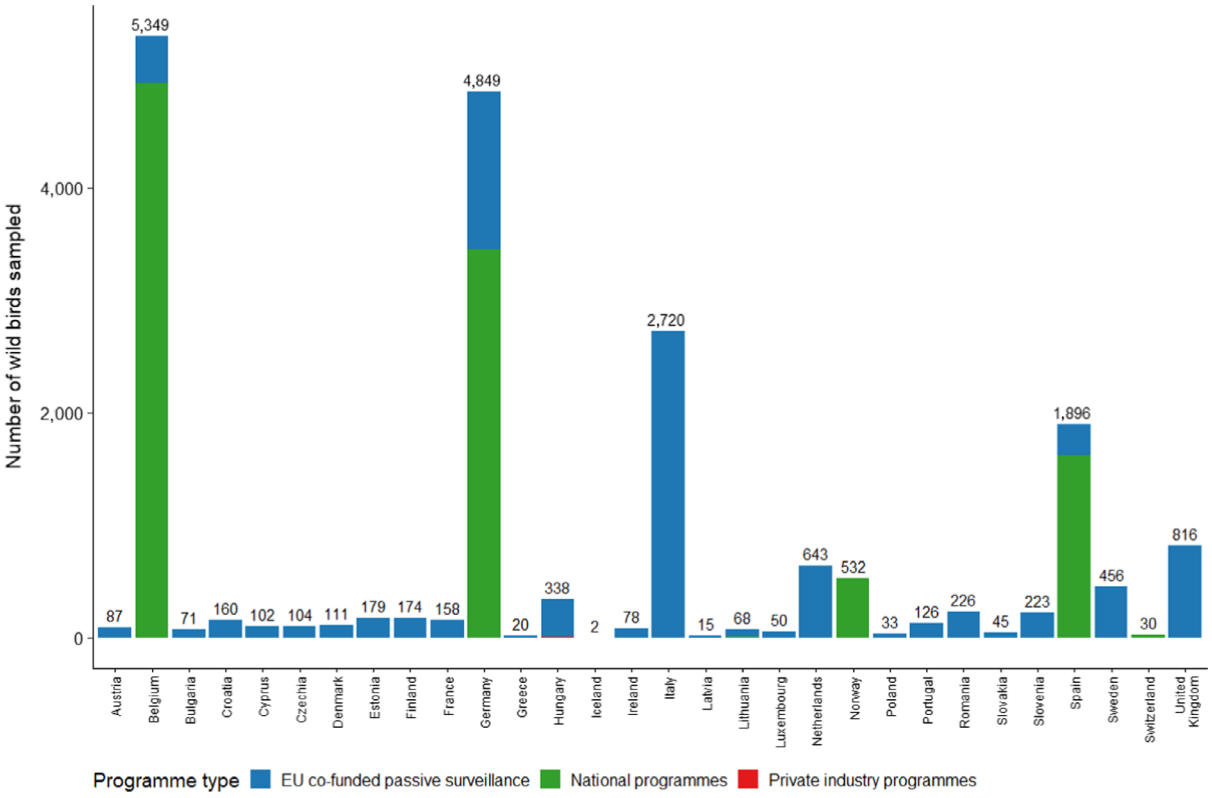

Figure 12: Number of wild birds sampled by RCs in 2019 according to the type of surveillance programme. The category represented in red (industry/private programme) is barely visible due to small sample size (four birds sampled in Hungary) (n = 19,661)

For the purpose of this report, birds 'found dead' or 'live with clinical signs' were classified under passive surveillance (the latter including injured birds), while birds reported as 'hunted with clinical signs', 'hunted without clinical signs' and 'live without clinical signs' were considered as birds sampled via active surveillance. This is consistent with the classification method followed in previous reports.

All 30 RCs reported results from their passive surveillance. From the total number of birds sampled, 8,926 (45%) were sampled by passive surveillance in 2019, almost as many birds as in 2018, but less than in 2016–2017 (Table 1). The sensitivity of passive surveillance for AI in wild bird is highly dependent on the probability of contributors discovering and reporting birds found dead, injured or with clinical signs.

Some RCs (n = 12) also performed and reported results active surveillance data (non-mandatory reporting), particularly, Belgium, Estonia, Germany, Norway and Spain who sampled a higher number of birds by active than by passive surveillance (Table 1). Although active surveillance was carried out in

other RCs apart from those mentioned above, the data shown in the report represent the data submitted to EFSA only (e.g. Denmark sampled 892 wild birds via active surveillance in 2019 (Hjulsager, 2020), but data were not submitted to EFSA). As reporting active surveillance results in wild birds to EFSA is not mandatory, the numbers reported below for active surveillance do not represent the full extent of activities conducted by some RCs. Consequently, this report contains complete data for passive surveillance only and mainly focuses on summarising the sampling activities and results obtained by passive surveillance.

Table 1: Number of wild birds sampled by RC in 2019 (light grey background), with active and passive surveillance presented separately and combined as a total, and number of wild birds sampled by passive surveillance from 2016 to 2018 (no background colour). Small figures or no data for active surveillance do not mean that no active surveillance was carried out in that RC, rather, little or no data were reported to EFSA from that RC

Reporting country	Passive surveillance				Active surveillance 2019	Total 2019
	2016	2017	2018	2019		
Austria	201	897	109	85	2	87
Belgium	280	367	237	423	4,926	5,349
Bulgaria	9	47	58	65	6	71
Croatia	116	279	223	160	0	160
Cyprus	124	117	109	87	15	102
Czechia	89	330	94	104	0	104
Denmark	204	154	148	111	0	111
Estonia	5	38	16	8	171	179
Finland	208	316	195	174	0	174
France	190	766	113	158	0	158
Germany	5,861	8,533	1,711	1,392	3,457	4,849
Greece	16	90	13	12	8	20
Hungary	960	703	371	338	0	338
Iceland	-	-	-	2	0	2
Ireland	25	137	142	78	0	78
Italy	1,899	2,019	2,109	2,719	1	2,720
Latvia	3	11	14	15	0	15
Lithuania	22	131	70	63	5	68
Luxembourg	2	61	–	50	0	50
Malta	–	–	–	–	–	–
Netherlands	536	509	663	643	0	643
Norway	–	–	–	28	504	532
Poland	85	209	36	33	0	33
Portugal	116	54	82	126	0	126
Romania	275	528	244	201	25	226
Slovakia	32	513	84	45	0	45
Slovenia	151	556	178	223*	0	223*
Spain	264	370	344	281	1,615	1,896
Sweden	354	452	455	456	0	456
Switzerland	264	162	45	30	0	30
United Kingdom	537	1,194	1,282	816	0	816
Total	**12,828**	**19,543**	**9,145**	**8,926**	**10,735**	**19,661**

*: Data on eight extra birds sampled by Slovenia could not be incorporated in this report as they were submitted to EFSA close to the publication date.

3.2.2. Timing of sampling in wild birds

In Figure 13, the quarterly distribution of the number of birds sampled by passive surveillance, starting in January 2019, is shown by RC. The highest number of samples was taken during the third

quarter (July–September). Overall, the distribution of number of birds by quarter was relatively consistent:

- Quarter 1: 2,276 birds, 25%
- Quarter 2: 1,984 birds, 22%
- Quarter 3: 2,727 birds, 31%
- Quarter 4: 1,939 birds, 22%

Figure 13 shows some variation among RCs in terms of the sampling distribution throughout the year (percentage of samples taken at each quarter by each RC). For example, the largest percentage of samples for Denmark and Norway was taken during the first quarter, for Estonia and Luxembourg during the second quarter, while Croatia, Hungary, Portugal and Romania sampled the most in the last quarter. This distribution was different from the distribution of sampling observed in 2018. In addition, Iceland collected all the samples during the fourth quarter, while Estonia, Luxembourg and Norway did not report any samples for the fourth quarter of 2019.

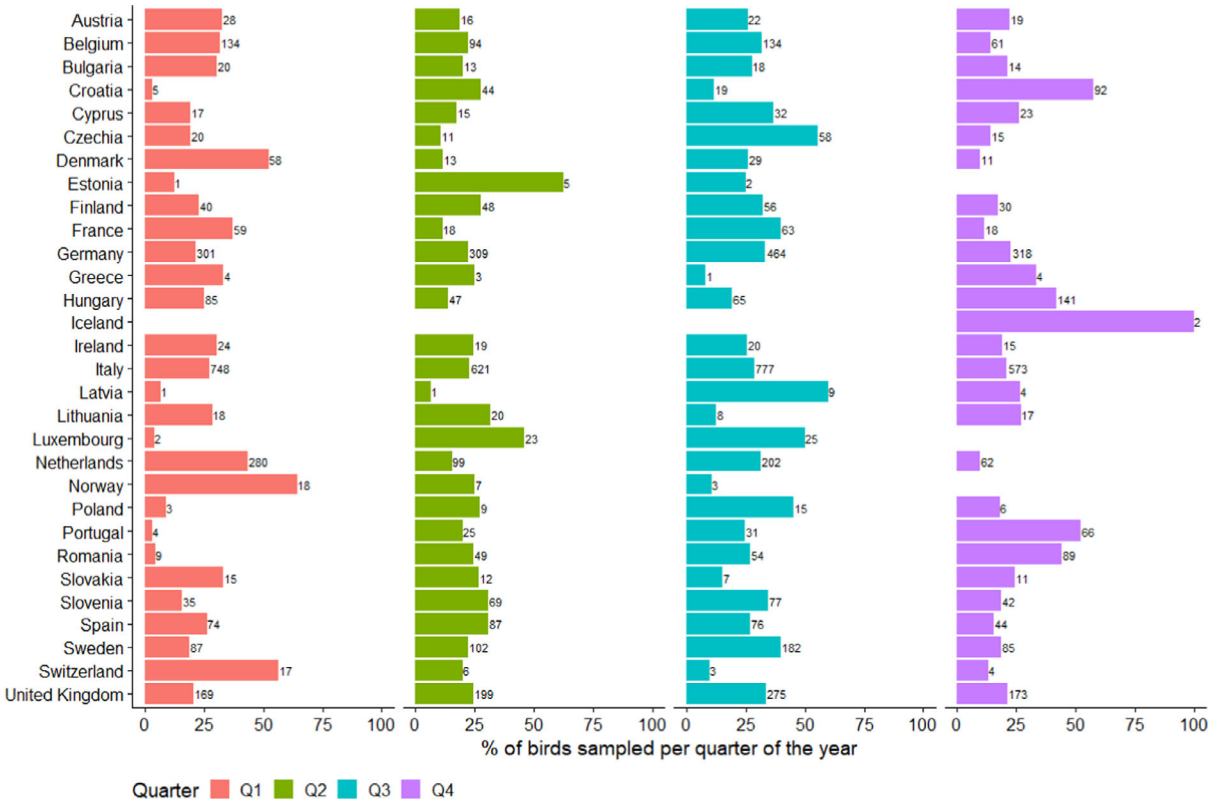

Figure 13: Quarterly percentage (bars) and total number (values) of wild birds sampled by passive surveillance by RC in 2019, with quarter 1 starting in January 2019 (n = 8,926)

3.2.3. Species distribution in wild birds

Among wild birds sampled via passive surveillance, 7,474 birds were fully identified with a species name. These samples belonged to a total of 244 wild bird species belonging to 22 orders. In addition, there were 1,302 birds for which only the genus was identified but not the species (11 orders), 42 birds for which only the order was identified (7 orders), and 108 birds for which identification information was completely missing. Birds from the latter category are shown under the group name 'Species unknown' in Figure 14.

The most sampled order was Anseriformes (n = 2,169), which accounted for 24.3% of the total number of birds sampled by passive surveillance. The orders Passeriformes, Charadriiformes and Accipitriformes were also sampled in high numbers (n > 1,000) (Figure 14).

Active surveillance samples were also mostly taken from birds of the order Anseriformes. A total of 9,570 samples from this order were tested by active surveillance, out of a total of 10,735 samples

tested (89.1%). The distribution of birds sampled by order is shown jointly for active and passive surveillance in Figure C.1 – Appendix C.

The majority of the species sampled by passive surveillance belonged to the orders Passeriformes (n = 70 species), Anseriformes (n = 39), Charadriiformes (n = 36) and Accipitriformes (n = 30). In Figure 15, the 40 species with the most birds sampled in 2019 are shown (out of 244 fully identified species). *Anas platyrhynchos* (mallard) was the most sampled species, similar to the data reported for 2018. This was followed by *Buteo buteo* (common buzzard), *Cygnus olor* (mute swan) and *Columba livia* (common pigeon). All English common names for the species shown in Figure 15 are listed in Table D.1 – Appendix D.

Forty-seven out of the 50 recommended target species by EFSA (EFSA, 2017) are included in the 244 species reported (see Table E.1 – Appendix E). Respectively, 37.9% and 74.6% of the birds sampled by passive and active surveillance belonged to target species (n = 3,381 and 8,006). Note that active surveillance was only reported by five RCs (Belgium, Estonia, Germany, Norway and Spain).

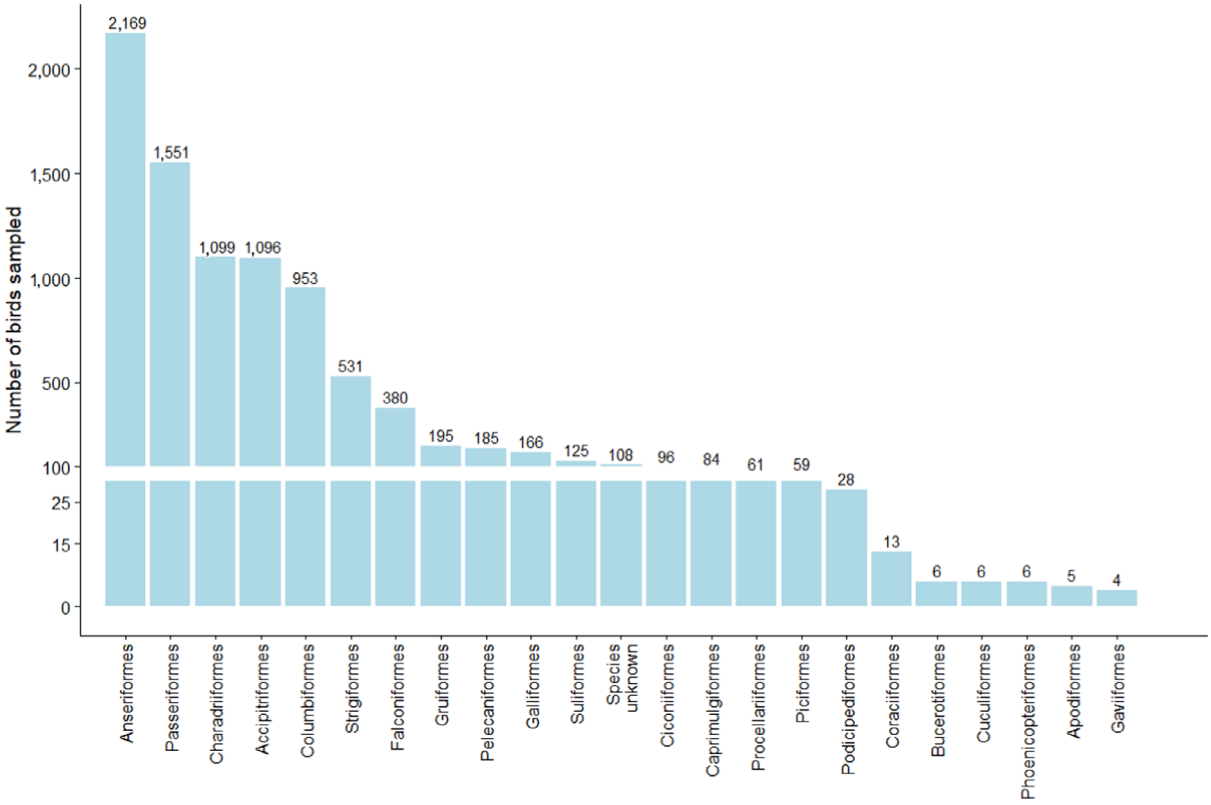

Figure 14: Total number of wild birds of the different orders, sampled by passive surveillance in 2019 (n = 8,926)

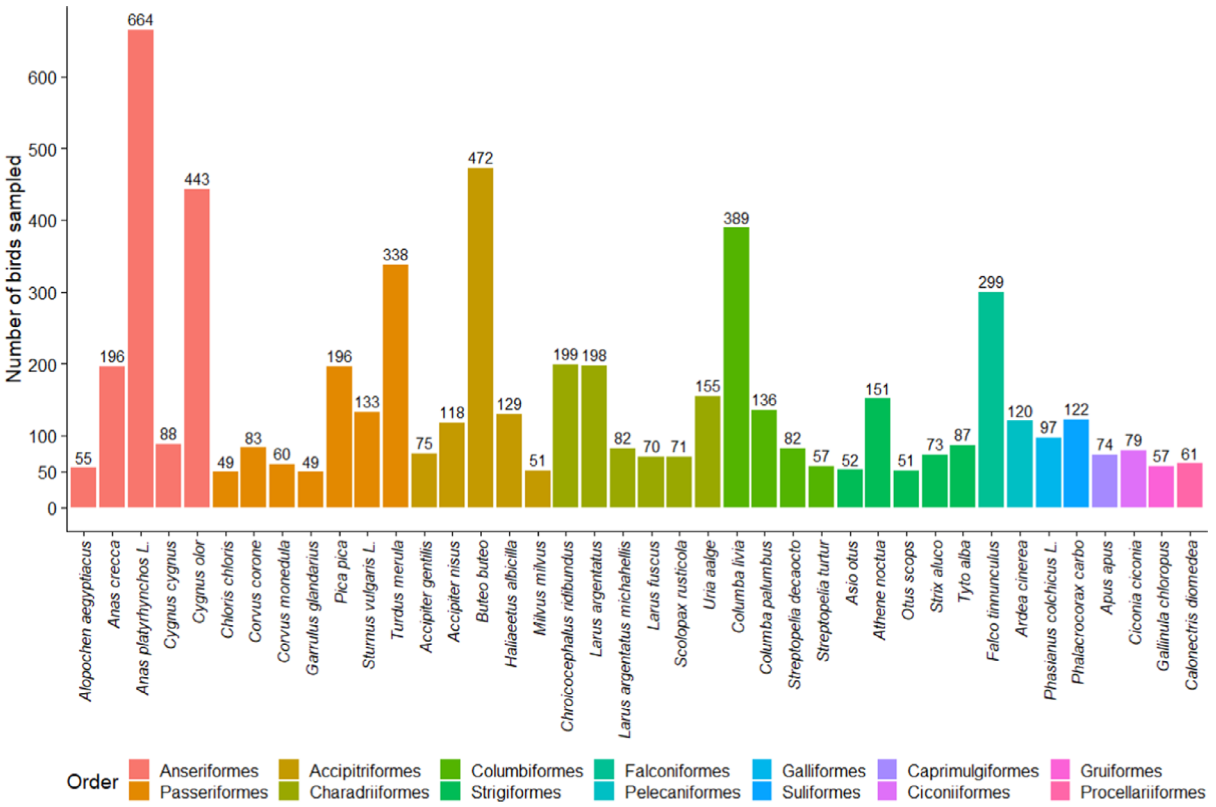

Figure 15: Total number of birds sampled for the 40 most sampled wild bird species reported by passive surveillance in 2019 (5,961 birds out of 7,474 fully identified birds). The bar colours refer to the bird orders. English common names for the species shown are provided in Appendix D

3.2.4. Avian influenza in wild birds

3.2.4.1. Detection of avian influenza virus in samples

When analysing data from both active and passive surveillance, a total of 933 (4.7%) birds, out of the 19,661 sampled by RCs, tested positive to AI (Table 2). This proportion was higher than for 2018 (3.8%). Of the 933 positive birds, only one (a bird found dead) was infected with HPAI virus. There were no AI-positive birds among birds showing clinical signs (hunted or live). All AI-positive birds were found dead (68 birds tested AI positive, including one positive for HPAI) or without clinical signs (hunted, n = 525 positive birds, or live, n = 340 positive birds). The majority of AI detections were found by active surveillance (93%), but the contribution of passive surveillance to the number of AI-positive birds was higher than in 2018. The proportions of positive birds in active and passive surveillance were 8% and 1%, respectively.

Table 2: Avian influenza diagnostic results for birds sampled by passive (no background) and active (light grey background) surveillance by all RCs in 2019, by bird status. The column 'All positive' includes all AI-positive birds obtained by polymerase chain reaction (PCR) or virus isolation (VI). All birds with a successful AI virus isolation (column 'Positive in VI') had previously tested positive by PCR

	Bird status	No. of birds sampled	No. of AI positive		
		No. of birds	All positive	Positive in VI	HPAI positive
active	Hunted with clinical signs	14	0	0	0
	Hunted without clinical signs	4,107	525	175	0
	Live without clinical signs	6,614	340	62	0
	Subtotal	10,735	865	237	0

	Bird status	No. of birds sampled	No. of AI positive		
		No. of birds	All positive	Positive in VI	HPAI positive
passive	Found dead	8,425	68	1	1
	Live with clinical signs	501	0	0	0
	Subtotal	8,926	68	1	1
Total		19,661	933	238	1

Wild bird sampling was reported for 21 NUTS2 units, 129 NUTS3 units and 6,743 individual coordinate locations in 2019. Italy reported surveillance results at NUTS2 level, while Czechia, Hungary, Iceland, Ireland, Latvia, Lithuania, the Netherlands, Norway, Poland and Romania reported results at NUTS3 level. Other countries reported results by location coordinates.

Out of the 19,661 wild birds sampled, 2,720 and 2,039 were reported at NUTS2 and NUTS3 level, respectively, while 14,902 were reported by location coordinates. Out of 85 H5 or H7 AI-positive birds (46 H5 LPAI, 38 H7 LPAI and 1 H5 HPAI birds), four and four were reported at NUTS2 and NUTS3 level, respectively, while 77 were reported by location coordinates. Overall, avian influenza was found in wild birds in 16 RCs, located throughout Europe.

Figure 16 shows the geographical distribution of AI surveillance activities conducted by RCs in wild birds in 2019. Separate maps show the distribution of AI-positive birds (all AIV types) and the distribution of H5/H7-positive birds only. Data are represented at the NUTS level they were reported at (i.e. the maps show a combination of NUTS2 and NUTS3 units). Data reported with location coordinates were aggregated at NUTS3 level.

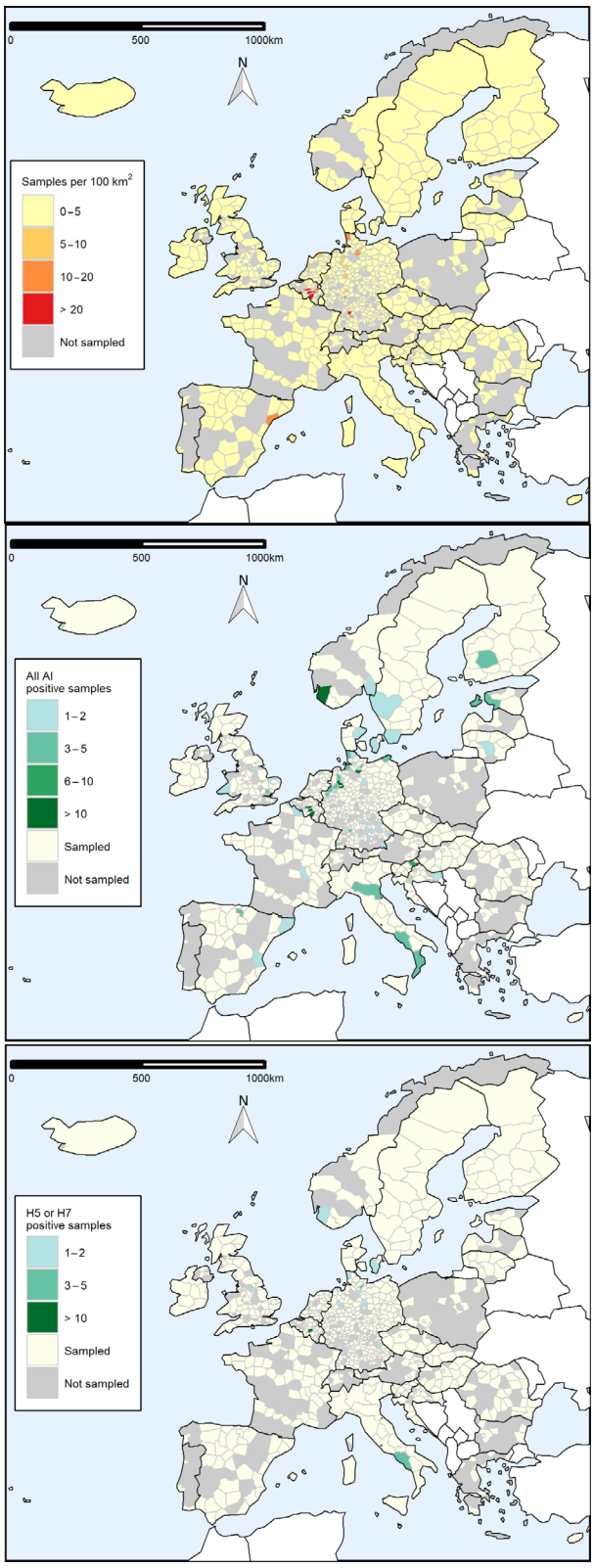

Figure 16: Sampling density, expressed as the number of wild birds sampled per area of 100 km^2 (upper map), and geographical distribution of all AI-positive birds (middle map) and H5/H7 positive birds (lower map), by administrative unit. Non-reporting countries are shown in white

A total of 21 wild bird species and birds from four genera with unknown species were detected as positive for AI, as well as seven birds with no species identification (no order, genus or species). The AI infected birds belonged to the orders Anseriformes, Charadriiformes, Passeriformes, Columbiformes and Accipitriformes (Figure 17). Most of the AI-positive birds belonged to the EFSA target species (n = 888, 95%).

The percentage of AI-positive birds by species shown in Figure 17C must be interpreted carefully, as the number of birds sampled for a given species may be very small. For instance, there were only one, two and three birds sampled in species *Tringa ochropus*, *Phylloscopus trochilus* and *Gallinago gallinago*, respectively, explaining the high proportion of positive samples in these species (Figure 17A).

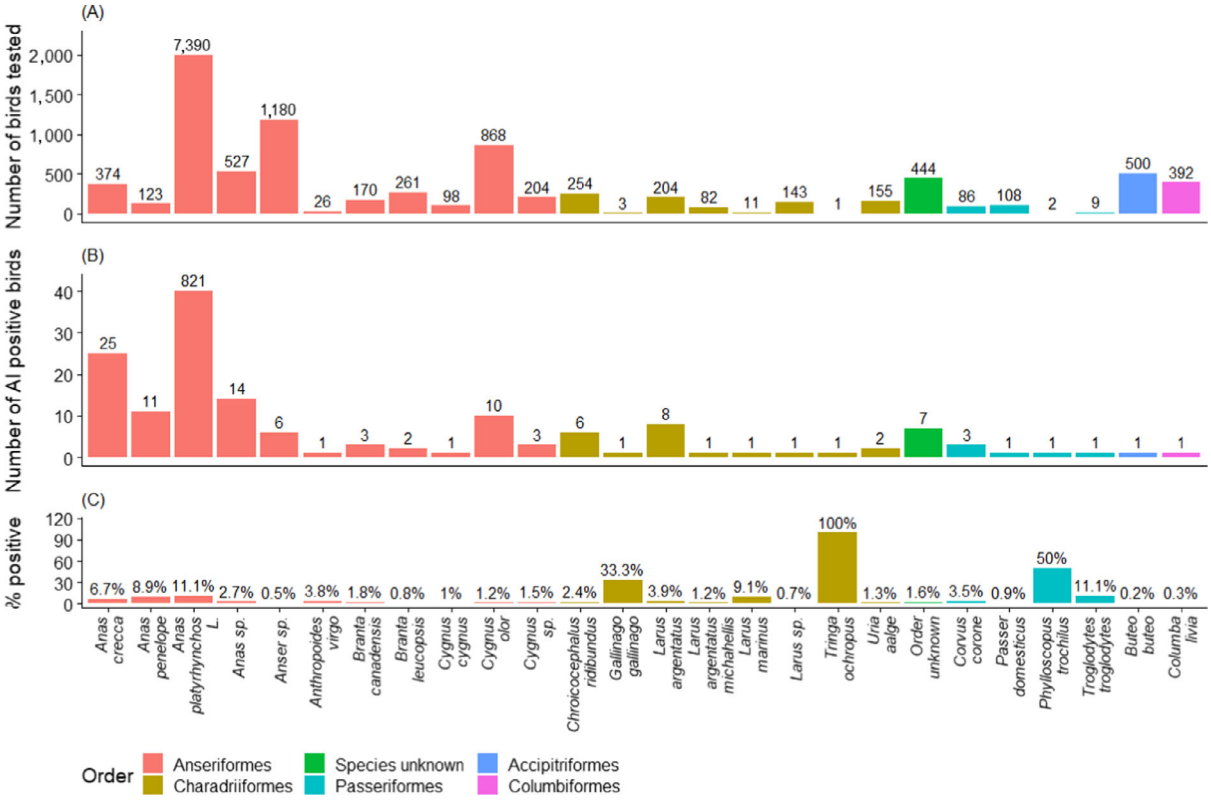

Figure 17: (A) Number of wild birds tested by both passive and active surveillance by species. (B and C) Number and proportion of AI-positive (all types) wild birds detected. Bars are colour coded to identify the order to which these species belong to. English common names are provided in Appendix D. In the panels (A) and (B), the height of the bars for *Anas platyrhynchos L.* was truncated as the numbers in this species were much higher than in other species

3.2.4.2. Highly pathogenic avian influenza in wild birds

In the data submitted for 2019, HPAI virus was detected in one bird only. This number is much lower than the 163 HPAI-positive birds identified in 2018. The positive sample originated from a common buzzard (*Buteo buteo*), found dead and submitted via passive surveillance in Denmark. The HPAI strain was identified as H5N6.

3.2.4.3. Low pathogenic avian influenza in wild birds

Among the 932 birds which tested positive for non-HPAI virus, 291 birds were infected with viruses reported as low pathogenic, while the virus pathogenicity results were not available for the remaining 641 birds. Out of the 641 birds for which information on the pathogenicity was not available, there was only one bird positive for H5, all other birds were positive for subtypes other than H5 or H7. For the remainder of this section, 'LPAI-positive' birds include all positive birds which were not positive for HPAI (n = 932). This is consistent with previous reports.

LPAI-positive birds were reported by 16 RCs. Among these positives, 46 were subtyped as H5 and 38 as H7. The majority of the LPAI viruses detected were reported as non-H5/H7 (n = 659), without further information on the virus subtype provided. Figure 18 summarises all the identified and reported LPAI subtypes.

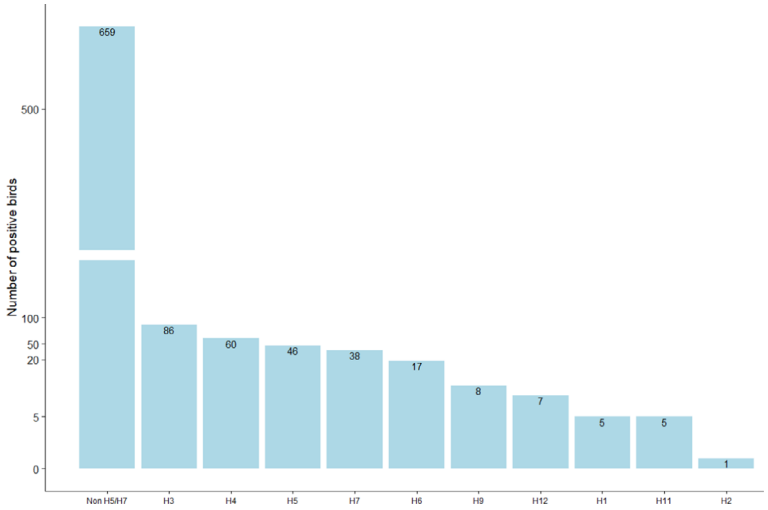

Figure 18: Number of LPAI-positive wild birds by AI virus haemagglutinin (H) type identified (n = 932). Values are provided above the bars. The Y-axis is presented on a non-linear scale to improve visibility. Note: birds for which positive samples could not all be typed (for instance, one sample was characterised as H4 and another sample from the same bird as H-antigen unknown) are classified under the available H type (in this example, H4). There were no birds with more than one H antigen identified

Among countries reporting LPAI-positive detections, the percentage of positives ranged from 0.2% to 0.6% for H5 subtypes, 0.1% to 0.6% for H7 subtypes and 0.3% to 13.4% for other subtypes (Table 3).

Table 3: Total number of wild birds sampled and positive for LPAI by passive and active surveillance in each RC. The LPAI-positive birds are categorised by H subtype (H5, H7 or non-H5/H7). Cells with a grey background indicate that no positive birds were detected in that country for the corresponding H subtype

Country	Passive surveillance				Active surveillance			
	No. of birds	No. H5 positive (%)	No. H7 positive (%)	No. non H5/H7 positive (%)	No. of birds	No. H5 positive (%)	No. H7 positive (%)	No. non H5/H7 positive (%)
Austria	85	0 (0)	0 (0)	1 (1.2)	2	0 (0)	0 (0)	0 (0)
Belgium	423	0 (0)	0 (0)	0 (0)	4,926	25 (0.5)	32 (0.6)	658 (13.4)
Bulgaria	65	0 (0)	0 (0)	0 (0)	6	0 (0)	0 (0)	0 (0)
Croatia	160	0 (0)	0 (0)	1 (0.6)	0	–	–	–
Cyprus	87	0 (0)	0 (0)	0 (0)	15	0 (0)	0 (0)	0 (0)
Czechia	104	0 (0)	0 (0)	0 (0)	0	–	–	–
Denmark	111	0 (0)	0 (0)	2 (1.8)	0	–	–	–
Estonia	8	0 (0)	0 (0)	0 (0)	171	0 (0)	0 (0)	5 (2.9)
Finland	174	0 (0)	0 (0)	3 (1.7)	0	–	–	–
France	158	0 (0)	0 (0)	2 (1.3)	0	–	–	–
Germany	1,392	0 (0)	2 (0.1)	7 (0.5)	3,457	12 (0.3)	0 (0)	92 (2.7)
Greece	12	0 (0)	0 (0)	0 (0)	8	0 (0)	0 (0)	0 (0)
Hungary	338	0 (0)	0 (0)	0 (0)	0	–	–	–

Country	Passive surveillance				Active surveillance			
	No. of birds	No. H5 positive (%)	No. H7 positive (%)	No. non H5/H7 positive (%)	No. of birds	No. H5 positive (%)	No. H7 positive (%)	No. non H5/H7 positive (%)
Iceland	2	0 (0)	0 (0)	0 (0)	0	–	–	–
Ireland	78	0 (0)	0 (0)	0 (0)	0	–	–	–
Italy	2,719	0 (0)	4 (0.1)	9 (0.3)	1	0 (0)	0 (0)	0 (0)
Latvia	15	0 (0)	0 (0)	0 (0)	0	–	–	–
Lithuania	63	0 (0)	0 (0)	1 (1.6)	5	0 (0)	0 (0)	0 (0)
Luxembourg	50	0 (0)	0 (0)	0 (0)	0	–	–	–
Netherlands	643	3 (0.5)	0 (0)	4 (0.6)	0	–	–	–
Norway	28	0 (0)	0 (0)	0 (0)	504	1 (0.2)	0 (0)	33 (6.5)
Poland	33	0 (0)	0 (0)	0 (0)	0	–	–	–
Portugal	126	0 (0)	0 (0)	0 (0)	0	–	–	–
Romania	201	0 (0)	0 (0)	0 (0)	25	0 (0)	0 (0)	0 (0)
Slovakia	45	0 (0)	0 (0)	0 (0)	0	–	–	–
Slovenia	223	0 (0)	0 (0)	7 (3.1)	0	–	–	–
Spain	281	0 (0)	0 (0)	0 (0)	1,615	0 (0)	0 (0)	7 (0.4)
Sweden	456	0 (0)	0 (0)	2 (0.4)	0	–	–	–
Switzerland	30	0 (0)	0 (0)	0 (0)	0	–	–	–
United Kingdom	816	5 (0.6)	0 (0)	14 (1.7)	0	–	–	–

In Figure 19, the number of wild birds sampled (Figure 19A), and the percentage of those testing positive for LPAI (Figure 19B) are presented by week, for passive and active surveillance separately (blue and red colour respectively). In this figure, the total number of positives for LPAI by week and wild bird taxonomic order is also shown (Figure 19C). A higher percentage of positive results were found from August onwards (later than week 30) for both types of surveillance. The period with the lowest frequency of detections of LPAI was in spring (mid-March to beginning of June). Most LPAI-positive birds belonged to the order Anseriformes (Figure 19C), which is the order most sampled by both active and passive surveillance.

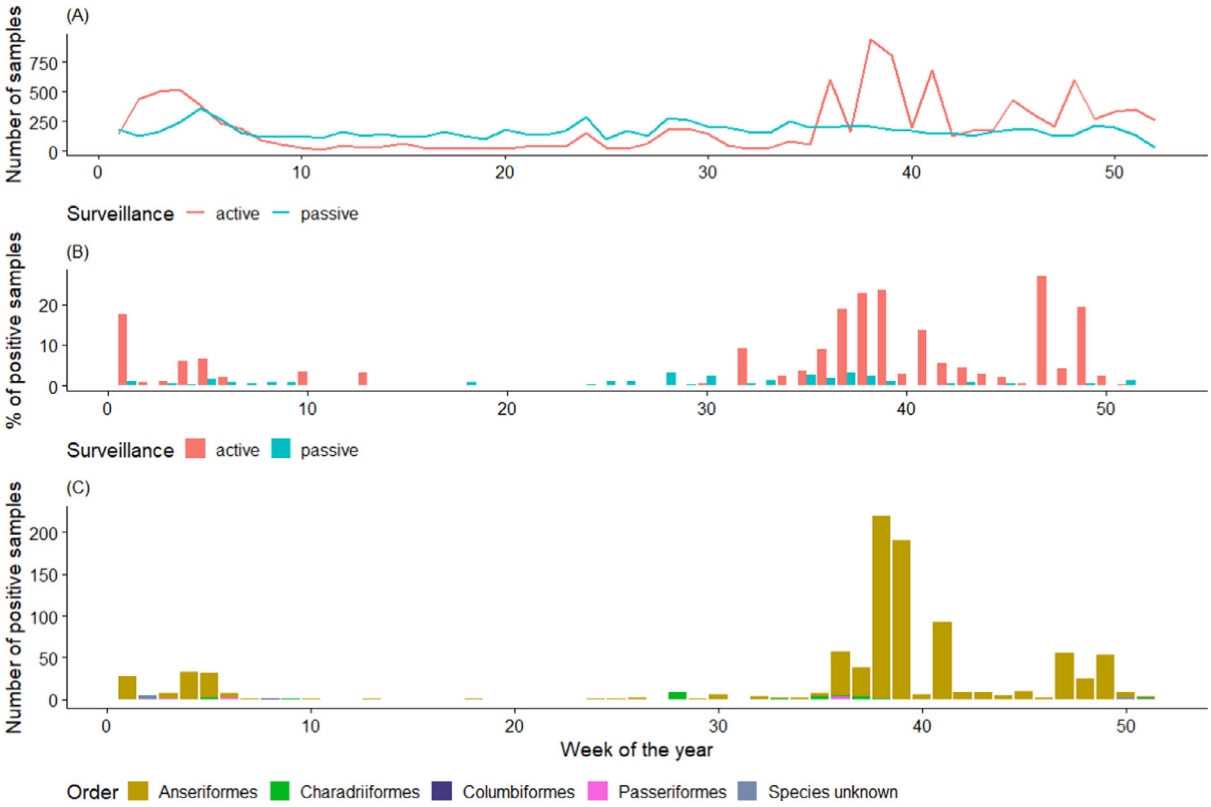

Figure 19: (A) Weekly number of wild birds sampled by both passive and active surveillance, (B) weekly percentage of LPAI-positive wild birds found and (C) weekly number of LPAI-positive wild birds by taxonomic order

3.3. Abundance and distribution of wild birds in Europe

Voluntary contribution data on abundance and distribution of the wild bird species have been made available to EFSA by the EuroBird Portal (EBP). EBP[14] is one of the three major monitoring projects run by the Euro Bird Census Council (EBCC). This project mobilises year-round observational data submitted by volunteer birdwatchers to the online bird recording portals operating across Europe (c. 50 million bird records from c. 100,000 bird observers annually). Information on the distribution of the 50 species included in the EFSA target list of wild bird species is now submitted to EFSA annually, aggregated at NUTS3 and monthly level. The data come to EFSA with two measures for each NUTS3 and month:

- the total number of birds observed at that specific location during that month;
- the number of birds of each of the 50 species included in the target list of species observed at that location during that month.

The total number of birds observed is a function of abundance and observation effort. This value may be used as an indirect measure of the effort that took place in a given location. However, it cannot be directly interpreted as the observation effort, as this would assume that abundance is constant across locations.

Figure F.1 in Appendix F shows the density of birds observed in a specific location (upper map), as well as the density of birds of the 50 target species (lower map), each estimated as the total number of observations in the NUTS3 region divided by the surface of the area (also available in Zenodo[15]). This figure shows that the density of observations of wild birds (all species, i.e. an indirect measure of observation effort) was highest in Belgium, the Netherlands and some regions of France, Germany, Switzerland and the United Kingdom. The density was lowest in Bulgaria, Croatia, Greece, Hungary, Ireland and Romania. No data were available for Iceland, Lithuania and Slovenia. Within countries, the

[14] https://eurobirdportal.org/ebp/en/#home/HIRRUS/r52weeks/CUCCAN/r52weeks/
[15] https://zenodo.org/10.5281/zenodo.4290183

variability between NUTS3 regions was high. During the course of the year, wild bird observations were reported at least once for 1,332 NUTS3 in total in the countries for which EBP data were available. Birds from the EFSA target list were reported in all but three of these NUTS3 (Figure F.1, lower map).

Showing these two types of records, observation effort and density for given species, provides an indicator of the reliability of the data presented. For example, if a small number of wild birds of the species included in the list of target species is observed for a certain NUTS3 and month, in an area where the observation effort is high (large number of total observations), our confidence in the reliability of that information would be higher than if the total number of observations was low.

Additional maps are available in Zenodo[2] at the monthly level: these maps display both the number of birds from target species observed in each NUTS3 (EBP data) and the number of birds from target species sampled by passive surveillance (RC data).

Figures F.2 and F.3 (Appendix F) show the distribution of bird observations according to the EBP data, by bird orders and species for the entire year, for the 50 species included in the EFSA target list (Appendix E). Almost half of the observations reported concerned Anseriformes, followed by Pelecaniformes, Charadriiformes, Accipitriformes and Passeriformes. It was not possible to compare these distributions with the distribution of orders and species sampled for AI surveillance, given that detailed data were only available for the target list species. For instance, Columbiformes ranked fifth in terms of sampling, but were not reported in the available EBP data.

Last, there were also some discrepancies between the wild birds reported as observed and the dead wild birds collected by the passive surveillance programmes. There were 1,817 records of dead bird samples from EFSA target species for a given species, NUTS3 and month. Among those, 511 were not associated with a corresponding observation in the EBP data. Therefore, it is difficult to use the EBP observation data to assess the quality of the passive surveillance in reporting countries.

4. Discussion and conclusions

It is important to note that risk-based sampling strategies are used for AI surveillance in some RCs, and that these strategies may vary between countries. Therefore, the differences observed between countries in this report in terms of AI incidence, both in poultry and wild birds, should be interpreted with caution and direct comparisons between countries avoided.

A targeted (non-representative) sampling approach helps to increase the efficiency of detection of AIV, but prevents valid assessments of measures of disease, differences between locations, categories or species or trends over time. Comparisons of seropositivity rates between different time periods, categories, species or locations are valid for the specific observations (surveillance results) only and cannot be extrapolated to the source populations. The seropositivity rates are not only influenced by disease but also the efficiency of targeting of the risk-based sampling approach. Therefore, increases in rates overtime may be due to changes in the disease situation, but also to improved targeting. As the risk-based surveillance is designed for early detection, it should not be used to measure changes in prevalence or incidence. If such an interpretation is required, representative sampling would need to be undertaken using methodologies that have been standardised between RCs.

4.1. Poultry

The number of PEs sampled in 2019 was higher than the number of PEs sampled each year since 2014 (inclusive), and almost as high as in 2013. In parallel, both the number and the proportion of H5/H7 seropositive establishments increased compared to those observed in 2018. Nine countries reported H5/H7 seropositive establishments: Belgium, Bulgaria, Denmark, France, Germany, the Netherlands, Poland, Spain, the United Kingdom. All these RCs except Bulgaria had reported H5/H7 seropositive PEs in 2018. Croatia, the Czech Republic and Sweden reported seropositive PEs in 2018 but not in 2019.

Three countries reported H5 and/or H7 PCR-positive results: Denmark (one H5N1 LPAI-positive PE and one H7N7 LPAI-positive PE), Bulgaria (four H5N8 HPAI-positive PEs) and Italy (one H7N3 LPAI-positive PE). Virus isolation from the two PCR-positive establishments in Denmark was also carried out, confirming the positive samples as H5N1 and H7N7 LPAI virus, respectively. These numbers were slightly higher than for 2018, where four PCR-positive PEs were reported, including three H5 LPAI (one each in Denmark, Italy and Sweden) and one H7 LPAI in Croatia. No AI virus could be isolated from the 2018 PCR-positive samples.

Variations in sampling activities among RCs and between years mean that it is difficult to make valid inferences about the detection percentages. As noted, each year since 2008, AI surveillance in 2019 showed a higher detection percentage of H5 than H7 seropositive establishments. This was also the case in wild birds, where more AI infections were characterised as H5 than H7. The present data still support the hypothesis that there is an overall higher risk of introduction of H5 viruses compared to H7 viruses in poultry in Europe.

The 2 months with the highest H5/H7 seropositivity rates were March and April 2019. These months were not the ones where poultry sampling was generally most intensive (September–November). In March, positive sampling events were mainly in free-range laying hens, while the sampling in this category was relatively consistent throughout the year. On the other hand, April coincided with most of the sampling in waterfowl game birds and most of the positive events in that category. Forty out of the 44 PEs reported as seropositive in April were waterfowl game bird holdings in Spain. Although this poultry category is sampled throughout the year, a large proportion of the sampling takes place at the end of the hunting season in the spring.

The highest rates of H5/H7 seropositive PEs were observed in waterfowl game birds, geese and ducks, with lower rates of seropositive results in gallinaceous species. Waterfowl game birds in particular showed a high rate of H5/H7 seropositive PEs (20.5%), while all other categories had much lower rates: the second category was breeding geese with a seropositivity rate of 5.1%. While H7 AI virus was detected in waterfowl game birds and free-range laying hens only, H5 AI virus was detected in 10 of the 16 poultry categories. No H5/H7 PEs were detected in the following categories: breeding chickens, broilers, breeding and fattening turkeys, growers and ratites. This pattern remains consistent with the surveillance results obtained from previous years as well as other studies.

In Commission Delegated Regulation (EU) 2020/689,[16] from April 2021, MSs are required to carry out a complementary risk-based surveillance aiming to detect clusters of establishments (in time and geographical proximity) infected with LPAI virus. The poultry categories where this surveillance is recommended include the categories where most of the serological positive results were found in 2019.

According to Commission Decision 2010/367/EU, MSs should follow up PEs with positive serology results by performing PCR testing on the same flock and/or neighbouring flocks.

Follow-up PCR results were not available for 29 of the seropositive PEs at the time of writing of the present report. This may be explained by a lack of follow-up, by a lack of reporting of these tests to EFSA or by the impossibility to link surveillance activities carried out in neighbouring flocks with specific seropositive results. It is important to note that no investigation identifiers were available at the time of analysis. Therefore, if follow-up testing was conducted on neighbouring flocks rather than on the same flock (i.e. with a different holding identifier), these events could not be linked and the seropositive event would have been classified as not followed up. The data collection allows to report follow-up activities ('sampInfo_origSampId'), and it is recommended that RCs use this feature accordingly. Last, a number of PCR test results were available without associated serology results. These PEs may correspond to flocks tested directly by PCR in the neighbourhood of seropositive flocks.

The results of the serological surveillance performed in 2019 are consistent with findings from previous years. The highest risk of circulation of LPAI remains in aquatic birds such as waterfowl game birds, geese and ducks. Broiler chickens, turkey breeders, growers and ratites were at low risk overall.

Finally, it is important to note that no data on the underlying poultry population were available to EFSA. This poultry population data could be submitted to EFSA in an aggregated manner (by poultry category and NUTS3 level) as a once-off exercise, with updates reported when available. Understanding the underlying population of the different poultry categories would improve the interpretation of the AI surveillance results at the European level.

4.2. Wild birds

Thirty RCs (including 26 MSs as well as Iceland, Norway, Switzerland and the United Kingdom) reported results of AI surveillance in wild birds for 2019. All RCs reported passive surveillance results, with 12 RCs also reporting active surveillance results. Wild bird sampling was reported at different levels by different RCs: NUTS2, NUTS3 or location coordinates. Standardisation of reporting using coordinate locations for all wild bird locations would allow to improve the mapping and spatial analysis of these results.

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0689&from=en

A very small decrease in the number of wild birds tested by passive surveillance was observed in 2019 with respect to 2018. Nonetheless, this was a much lower figure than reported for 2017 (19,543, 9,145 and 8,926 birds tested in 2017, 2018 and 2019, respectively). Eight countries sampled as many, or more, birds by passive surveillance as during the previous year. In some of the other countries, active surveillance activities compensated the decrease in passive surveillance. Thus, the total number of wild birds sampled in 2019 (19,661) was higher than the total for 2018 (15,252).

Notably, HPAI was detected in only one bird sample in 2019, in contrast with the 163 H5N6 HPAI-positive wild birds reported in 2018. In both years, all HPAI-positive birds were detected by passive surveillance, highlighting the importance of this surveillance approach for AI surveillance in wild bird species. The near-absence of HPAI-positive results preclude any further analysis on the distribution of risk, for instance in time and space. As the intensity of passive surveillance was very similar in 2019 (very small decrease compared to 2018 of total number of birds tested), a lower circulation rate of HPAI in wild birds in Europe in 2019 is plausible assuming no major change in surveillance strategies occurred. Alternatively, the HPAI strains circulating in 2019 could have been causing less mortality in wild birds compared to previously circulating AIV strains. Nonetheless, it is important to note that the percentage of birds sampled by passive surveillance belonging to the list of target species recommended by EFSA is still very low (38%), as mentioned above. This list includes species that are more likely to die if infected with HPAI. Reporting countries are encouraged to target these species in their passive surveillance activities when possible. Further research is recommended in order to provide a plausible list of wild bird species less likely to die if infected with HPAI. Identifying specific areas outside and inside the EU where active surveillance could take place at specific times of the year is also recommended.

The LPAI results remain consistent with previous years, where the period with the highest rate of LPAI detections is between September and February. A notable increase in the rate of LPAI infected wild birds was observed in 2019 (932 positive birds out of 19,661) compared to 2018 (422 positive birds out of 15,252).

In this year's report (Appendix F), summary data provided by the EuroBirdPortal project are presented to describe the number of wild bird observations reported by voluntary contributors in 2019. These data may provide some context regarding the performance of passive surveillance of AI in wild birds in the EU. However, it is important to note that the density of wild bird observations is the product of two factors:

- the density of wild birds (which depends on species-specific factors such as the location, biotope, time of the year, etc.)
- the probability that a wild bird is observed by someone and reported in a relevant database, given that it is present. This is also known as the 'effort' put into wild bird observations.

As a consequence, areas with low density of observations may correspond to areas where the sensitivity of passive surveillance is low due to a lower 'effort', or to habitats which are simply not favourable to birds (low density of birds), or both. A previous study in Sweden warned that contributor-based data should be used with care, given the limitations of this data collection method (Snäll et al., 2011). Despite the limitations of the voluntary observation data presented in this report, and until further spatial modelling of the distribution of wild birds in Europe by species is readily available, the maps presented in this report (and also those linked to this report and shown in Zenodo), could help to shed light on areas where the birds of the species belonging to the target list may gather, supporting RCs in carrying out more targeted surveillance activities.

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Abbreviations

AI	Avian Influenza
AIV	Avian Influenza A Virus
HPAI	High Pathogenic Avian Influenza
HPAI	Haemagglutinin
LPAI	Low Pathogenic Avian Influenza
MS	Member State
N	Neuraminidase
NUTS	Nomenclature of Territorial Units for Statistics
PE	Poultry Establishment
RC	Reporting Country

Appendix A – Comparison of detailed poultry establishment categories with previous reporting categories

Table A.1: Total number of PEs sampled and testing positive in 2019, according to the 16 poultry categories used in this report and to the detailed reporting categories available to MSs

Reporting category used in this report	Detailed reporting category	Number of sampling events	Number of H5- or H7-positive events
BACKYARD FLOCKS	Backyard	5,896	14
Breeding chickens	Breeding chickens	2,501	34
	Free-range breeding chickens	38	0
Breeding ducks	Breeding ducks	224	2
	Ducks	13	0
Breeding geese	Breeding geese	155	6
	Free-range breeding geese	2	2
Breeding turkeys	Breeding turkeys	182	0
Broilers (heightened risk)	Broilers	1,136	1
	Free-range broilers	184	1
Fattening ducks	Fattening ducks	889	32
	Free-range fattening ducks	20	3
Fattening geese	Fattening geese	326	7
	Free-range fattening geese	52	3
Fattening turkeys	Fattening turkeys	2,363	12
	Free-range fattening turkeys	32	0
Free-range laying hens	Free-range laying hens	3,144	101
Game birds (gallinaceous)	Farmed game birds (Gallinaceous)	374	8
	Free-range partridges	4	1
	Free-range pheasants	70	5
	Guinea-fowl	11	0
	Partridges	45	0
	Pheasants	116	0
	Quails	26	0
	Turkeys	2	0
Game birds (waterfowl)	Ducks	1	0
	Farmed game birds (Waterfowl)	169	79
	Free-range mallard ducks	13	4
	Mallard ducks	22	1
Growers	Chickens	145	0
	Generic poultry	1,093	0
	Turkeys	2	0
Laying hens	Laying hens	4,260	68
Others	Chickens	203	24
	Ducks	311	10
	Free-range chickens	1	0
	Free-range ducks	1	0
	Geese	106	2
	Other	24	2
	Parrots	1	0
	Pigeon breeding flock	1	0
	Turkeys	136	0

Reporting category used in this report	Detailed reporting category	Number of sampling events	Number of H5- or H7-positive events
Ratites	Free-range ostriches	17	0
	Free-range ratites	1	0
	Ostriches	37	0
	Other	1	0
	Ratites	69	0

Table A.2: Detailed mapping of the 16 poultry categories used in this report and the detailed reporting categories available to MSs, comprising the species, production method and purpose of raising poultry

Reporting category used in this report	Detailed reporting category	Poultry species	Purpose of raising	Production methods
Backyard flocks	Backyard	Duck (as animal)	Growers	Back yard farming - growing
		Duck (as animal)	Not Available	Back yard farming - growing
		Duck breeding flock (as animals)	Not Available	Back yard farming - growing
		Duck fattening animal (as animal)	Not Available	Back yard farming - growing
		Gallus gallus (chicken) (as animal)	Growers	Back yard farming - growing
		Gallus gallus (chicken) (as animal)	Not Available	Back yard farming - growing
		Gallus gallus breeding flock (as animals)	Not Available	Back yard farming - growing
		Gallus gallus broiler (as animal)	Not Available	Back yard farming - growing
		Gallus gallus laying hens (as animal)	Not Available	Back yard farming - growing
		Generic poultry (as animal)	Growers	Back yard farming - growing
		Generic poultry (as animal)	Not Available	Back yard farming - growing
		Goose (as animal)	Not Available	Back yard farming - growing
		Goose breeding flock (as animals)	Not Available	Back yard farming - growing
		Turkey (as animal)	Not Available	Back yard farming - growing
		Turkey breeding flock (as animals)	Not Available	Back yard farming - growing
		Turkey fattening animal (as animal)	Not Available	Back yard farming - growing
Breeding chickens	Breeding chickens	Gallus gallus breeding flock (as animals)	Breeding purpose	Not Available
		Gallus gallus breeding flock (as animals)	Not Available	Not Available
	Free-range breeding chickens	Gallus gallus breeding flock (as animals)	Not Available	Outdoor/free-range growing condition
Breeding ducks	Breeding ducks	Duck breeding flock (as animals)	Breeding purpose	Not Available
		Duck breeding flock (as animals)	Game purpose	Not Available
		Duck breeding flock (as animals)	Not Available	Not Available
	Ducks	Duck (as animal)	Breeding purpose	Not Available
Breeding geese	Breeding geese	Goose breeding flock (as animals)	Breeding purpose	Not Available
		Goose breeding flock (as animals)	Not Available	Not Available
	Free-range breeding geese	Goose breeding flock (as animals)	Not Available	Outdoor/free-range growing condition

Reporting category used in this report	Detailed reporting category	Poultry species	Purpose of raising	Production methods
Breeding turkeys	Breeding turkeys	Turkey breeding flock (as animals)	Breeding purpose	Not Available
		Turkey breeding flock (as animals)	Not Available	Not Available
Broilers (heightened risk)	Broilers	Gallus gallus broiler (as animal)	Meat production purpose	Not Available
		Gallus gallus broiler (as animal)	Not Available	Not Available
	Free-range broilers	Gallus gallus broiler (as animal)	Not Available	Outdoor/free-range growing condition
Fattening ducks	Fattening ducks	Duck fattening animal (as animal)	Meat production purpose	Not Available
		Duck fattening animal (as animal)	Not Available	Not Available
	Free-range fattening ducks	Duck fattening animal (as animal)	Not Available	Outdoor/free-range growing condition
Fattening geese	Fattening geese	Goose fattening animal (as animal)	Meat production purpose	Not Available
		Goose fattening animal (as animal)	Not Available	Not Available
	Free-range fattening geese	Goose fattening animal (as animal)	Not Available	Outdoor/free-range growing condition
Fattening turkeys	Fattening turkeys	Turkey fattening animal (as animal)	Meat production purpose	Not Available
		Turkey fattening animal (as animal)	Not Available	Not Available
	Free-range fattening turkeys	Turkey fattening animal (as animal)	Not Available	Outdoor/free-range growing condition
Free-range laying hens	Free-range laying hens	Gallus gallus laying hens (as animal)	Not Available	Outdoor/free-range growing condition
Game birds (gallinaceous)	Farmed game birds (Gallinaceous)	Galliformes (as animal)	Game purpose	Not Available
		Galliformes (as animal)	Not Available	Not Available
		Peafowl (as animal)	Not Available	Not Available
	Free-range partridges	Partridge (as animal)	Game purpose	Outdoor/free-range growing condition
	Free-range pheasants	Pheasant (as animal)	Game purpose	Outdoor/free-range growing condition
	Guinea-fowl	Guinea-fowl (as animal)	Not Available	Not Available
	Partridges	Partridge (as animal)	Breeding purpose	Not Available
		Partridge (as animal)	Not Available	Not Available
		Partridge breeding flock (as animals)	Game purpose	Not Available
		Partridge breeding flock (as animals)	Not Available	Not Available

Reporting category used in this report	Detailed reporting category	Poultry species	Purpose of raising	Production methods
	Pheasants	Pheasant (as animal)	Game purpose	Not Available
		Pheasant (as animal)	Not Available	Not Available
		Pheasant breeding flock (as animals)	Breeding purpose	Not Available
		Pheasant breeding flock (as animals)	Game purpose	Not Available
		Pheasant breeding flock (as animals)	Not Available	Not Available
		Pheasant laying hens (as animal)	Not Available	Not Available
	Quails	Common Quail (as animal)	Not Available	Not Available
		Quail (as animal)	Not Available	Not Available
		Quail breeding flock (as animals)	Breeding purpose	Not Available
		Quail fattening animal (as animal)	Not Available	Not Available
		Quail laying hens (as animal)	Not Available	Not Available
	Turkeys	Turkey (as animal)	Game purpose	Not Available
Game birds (waterfowl)	Ducks	Duck (as animal)	Game purpose	Not Available
	Farmed game birds (Waterfowl)	Anseriformes (as animal)	Game purpose	Not Available
		Anseriformes (as animal)	Not Available	Not Available
	Free-range mallard ducks	Mallard (as animal)	Game purpose	Outdoor/free-range growing condition
	Mallard ducks	Mallard (as animal)	Game purpose	Not Available
		Mallard (as animal)	Not Available	Not Available
Growers	Chickens	Gallus gallus (chicken) (as animal)	Growers	Not Available
	Generic poultry	Generic poultry (as animal)	Growers	Not Available
	Turkeys	Turkey (as animal)	Growers	Not Available
Laying hens	Laying hens	Gallus gallus laying hens (as animal)	Not Available	Not Available
Others	Chickens	Gallus gallus (chicken) (as animal)	Not Available	Not Available
	Ducks	Duck (as animal)	Meat production purpose	Not Available
		Duck (as animal)	Not Available	Not Available
		Duck laying hens (as animal)	Not Available	Not Available
	Free-range chickens	Gallus gallus (chicken) (as animal)	Not Available	Outdoor/free-range growing condition
	Free-range ducks	Duck (as animal)	Not Available	Outdoor/free-range growing condition
	Geese	Goose (as animal)	Not Available	Not Available
		Goose laying hens (as animal)	Not Available	Not Available
	Other	Falco (as animal)	Not Available	Not Available
		Pigeon (as animal)	Not Available	Not Available
	Parrots	Parrots (as animal)	Not Available	Not Available
	Pigeon breeding flock	Pigeon breeding flock (as animals)	Not Available	Not Available
	Turkeys	Turkey (as animal)	Not Available	Not Available

Reporting category used in this report	Detailed reporting category	Poultry species	Purpose of raising	Production methods
Ratites	Free-range ostriches	Ostrich (as animal)	Not Available	Outdoor/free-range growing condition
	Free-range ratites	Ratite (as animal)	Not Available	Outdoor/free-range growing condition
	Ostriches	Ostrich (as animal)	Game purpose	Not Available
		Ostrich (as animal)	Not Available	Not Available
		Ostrich breeding flock (as animals)	Not Available	Not Available
		Ostrich fattening animal (as animal)	Not Available	Not Available
	Other	Emu (as animal)	Not Available	Not Available
	Ratites	Ratite (as animal)	Not Available	Not Available

Appendix B – Serological results by poultry species

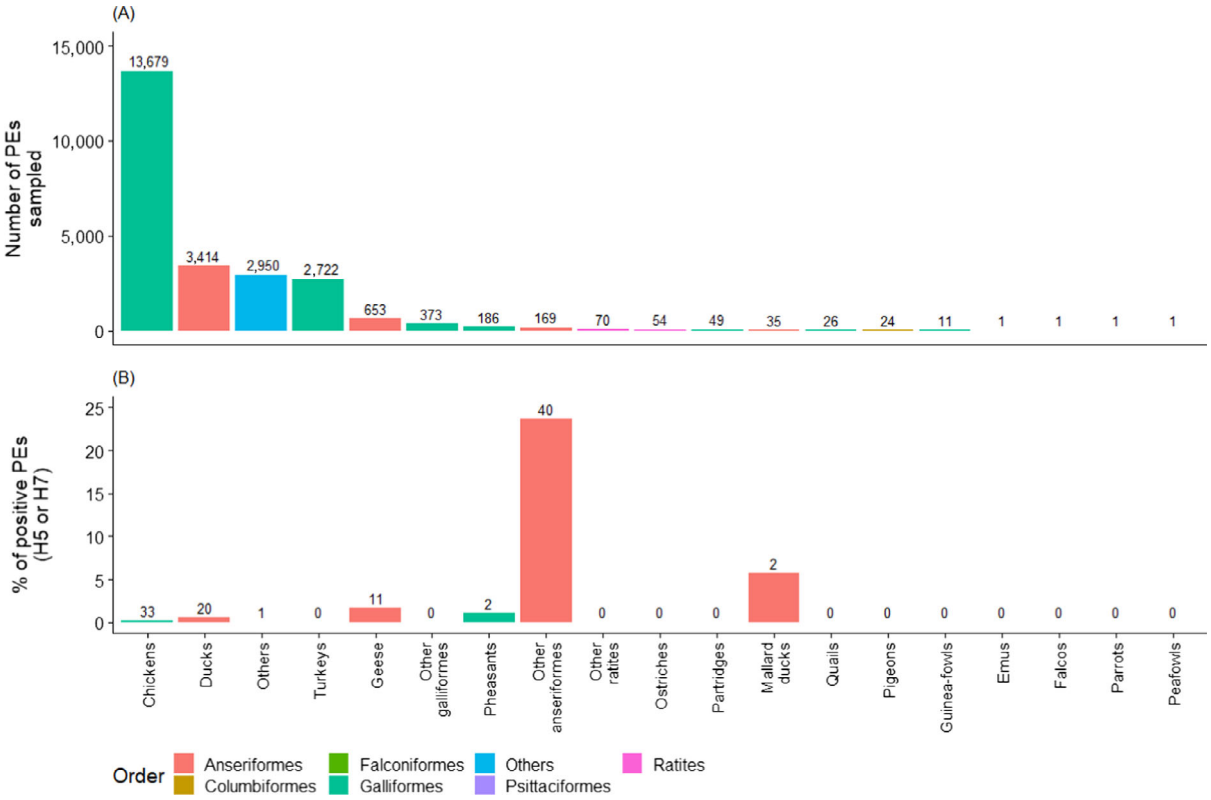

Figure B.1: (A) Number of PEs sampled by poultry species; (B) Proportion of PE sampled that tested positive for H5 or H7 AI virus in serology. The numbers above the bars indicate the number of seropositive PEs. Bars are colour coded to identify the order to which these species belong to. The species name was not reported for some PEs, which were only identified at the bird order level. Ostriches, emus and other ratites were classified under the term 'ratites' which is not an order, given that species names were not always available

Appendix C – Total number of wild birds of the different orders sampled by passive and active surveillance

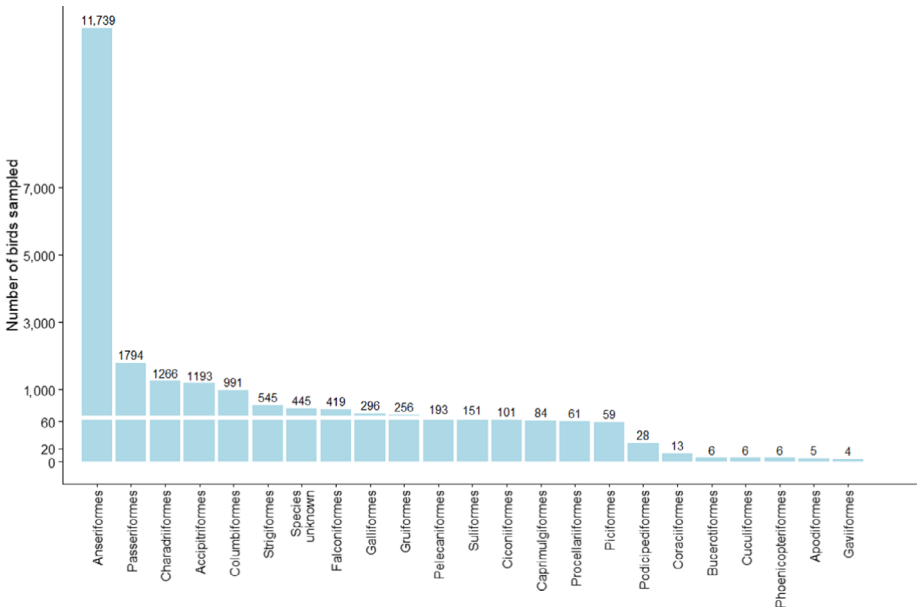

Figure C.1: Total number of wild birds of the different orders sampled by passive and active surveillance by RCs in 2019. The group 'Species unknown' includes all birds for which data on species and order were not available

Appendix D – Scientific and common names of wild bird species

Table D.1: English common names and scientific names of wild bird species mentioned in this report

Latin name	English common name
Anas platyrhynchos L.	Mallard
Buteo buteo	Common buzzard
Cygnus olor	Mute swan
Columba livia	Pigeon
Turdus merula	Common blackbird
Falco tinnunculus	Kestrel
Chroicocephalus ridibundus	Black-headed Gull
Larus argentatus	European herring Gull
Anas crecca	Common teal
Pica pica	Eurasian magpie
Uria aalge	Common murre
Athene noctua	Little owl
Columba palumbus	Common woodpigeon
Sturnus vulgaris L.	Starling
Haliaeetus albicilla	White-tailed eagle
Phalacrocorax carbo	Great cormorant
Ardea cinerea	Grey heron
Accipiter nisus	Sparrowhawk
Phasianus colchicus L.	Pheasant
Cygnus cygnus	Whooper swans
Tyto alba	Barn owl
Corvus corone	Carrion crow
Larus argentatus michahellis	Yellow-legged gull
Streptopelia decaocto	Collared dove
Ciconia ciconia	White stork
Accipiter gentilis	Northern goshawk
Apus apus	Common swift
Strix aluco	Tawny owl
Scolopax rusticola	Eurasian woodcock
Larus fuscus	Lesser black backed gull
Calonectris diomedea	Scopoli's shearwater
Corvus monedula	Jackdaw
Gallinula chloropus	Moorhen
Streptopelia turtur	European turtle dove
Alopochen aegyptiacus	Egyptian goose
Asio otus	Long-eared Owl
Milvus milvus	Red kite
Otus scops	Eurasian scops owl
Chloris chloris	European greenfinch
Garrulus glandarius	Eurasian jay

Appendix E – EFSA list of target wild bird species for avian influenza surveillance

Table E.1: List of target wild bird species published in December 2017 as part of the EFSA-ECDC-EURL scientific report (species not sampled in 2019 are highlighted in grey)

Family	Subfamiliy, tribe or genus	Species
Coots, crakes, and rails (*Rallidae*)		Western swamphen (*Porphyrio porphyrio*)
Cormorants and shags (*Phalacrocoracidae*)		Great cormorant (*Phalacrocorax carbo*)
Corvids (*Corvidae*)		Eurasian magpie (*Pica pica*)
Ducks, geese and swans (*Anatidae*)	Dabbling ducks (*Anatinae*)	Eurasian teal (*Anas crecca*)
	Dabbling ducks (*Anatinae*)	Eurasian wigeon (*Anas penelope*)
	Dabbling ducks (*Anatinae*)	Gadwall (*Anas strepera*)
	Dabbling ducks (*Anatinae*)	Mallard (*Anas platyrhynchos*)
	Dabbling ducks (*Anatinae*)	Northern pintail (*Anas acuta*)
	Diving ducks (*Aythyini*)	Common pochard (*Aythya ferina*)
	Diving ducks (*Aythyini*)	Greater scaup (*Aythya marila*)
	Diving ducks (*Aythyini*)	Red-crested pochard (*Netta rufina*)
	Diving ducks (*Aythyini*)	Tufted duck (*Aythya fuligula*)
	Sea ducks (*Mergini*)	Common eider (*Somateria mollissima*)
	Sea ducks (*Mergini*)	Common goldeneye (*Bucephala clangula*)
	Sea ducks (*Mergini*)	Goosander (*Mergus merganser*)
	Sea ducks (*Mergini*)	Smew (*Mergus albellus*)
	Shelducks and sheldgeese (*Tadorninae*)	Common shelduck (*Tadorna tadorna*)
	Shelducks and sheldgeese (*Tadorninae*)	Egyptian goose (*Alopochen aegyptiacus*)
	Swans (*Cygnus*)	Black swan (*Cygnus atratus*)
	Swans (*Cygnus*)	Mute swan (*Cygnus olor*)
	Swans (*Cygnus*)	Whooper swan (*Cygnus cygnus*)
	True geese (*Anser, Branta, Chen*)	Brant goose (*Branta bernicla*)
	True geese (*Anser, Branta, Chen*)	Canada goose (*Branta canadensis*)
	True geese (*Anser, Branta, Chen*)	Greater white-fronted goose (*Anser albifrons*)
	True geese (*Anser, Branta, Chen*)	Greylag goose (*Anser anser*)
	True geese (*Anser, Branta, Chen*)	Lesser white-fronted goose (*Anser erythropus*)
	True geese (*Anser, Branta, Chen*)	Pink-footed goose (*Anser brachyrhynchus*)
	True geese (*Anser, Branta, Chen*)	Taiga bean Goose (*Anser fabalis*)
Grebes (*Podicipedidae*)		Black-necked grebe (*Podiceps nigricollis*)
		Great crested grebe (*Podiceps cristatus*)
		Little grebe (*Tachybaptus ruficollis*)
Gulls, terns and allies (*Laridae*)		Black-headed gull (*Chroicocephalus ridibundus*)
		European herring gull (*Larus argentatus*)
		Great black-backed gull (*Larus marinus*)
		Mew gull (*Larus canus*)
Herons (*Ardeidae*)		Eurasian bittern (*Botaurus stellaris*)
		Great white egret (*Egretta alba*)
		Grey heron (*Ardea cinerea*)
		Little egret (*Egretta garzetta*)
Pelicans (*Pelecanidae*)		Dalmatian pelican (*Pelecanus crispus*)
		Great white pelican (*Pelecanus onocrotalus*)

Family	Subfamiliy, tribe or genus	Species
Raptors (*Accipitridae, Falconidae, Strigidae*)		Common buzzard (*Buteo buteo*)
		Eurasian eagle-owl (*Bubo bubo*)
		Northern goshawk (*Accipiter gentilis*)
		Peregrine falcon (*Falco peregrinus*)
		Rough-legged buzzard (*Buteo lagopus*)
		White-tailed eagle (*Haliaeetus albicilla*)
Sandpipers (*Scolopacidae*)		Green sandpiper (*Tringa ochropus*)
Storks (*Ciconiidae*)		White stork (*Ciconia ciconia*)
Thrushes (*Turdidae*)		Fieldfare (*Turdus pilaris*)

Note: Another wader (family *Scolopacidae*), Numenius species, was not included in this list because it was not identified to species. However, in the EU, the two most common Numenius species are the Eurasian curlew (*N. arquata*) and the whimbrel (*N. phaeopus*).

Appendix F – Wild bird observations by voluntary contributors

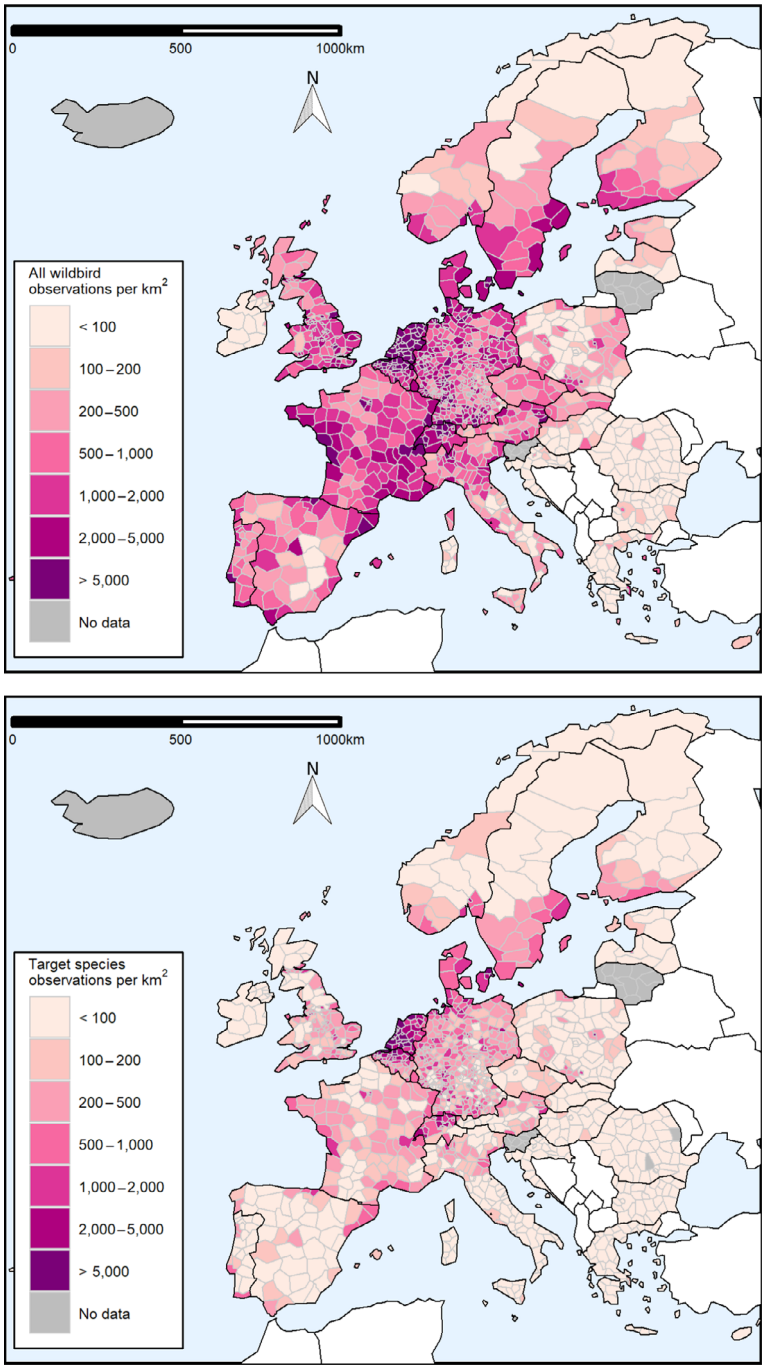

Figure F.1: Density of wild bird observations for 2019 by NUTS3 region, as per data provided by the EuroBirdPortal project. The density of observations was estimated as the total number of observations in the NUTS3 region divided by the surface of the area. The upper map shows all bird species, while the lower map is restricted to species from the EFSA target list

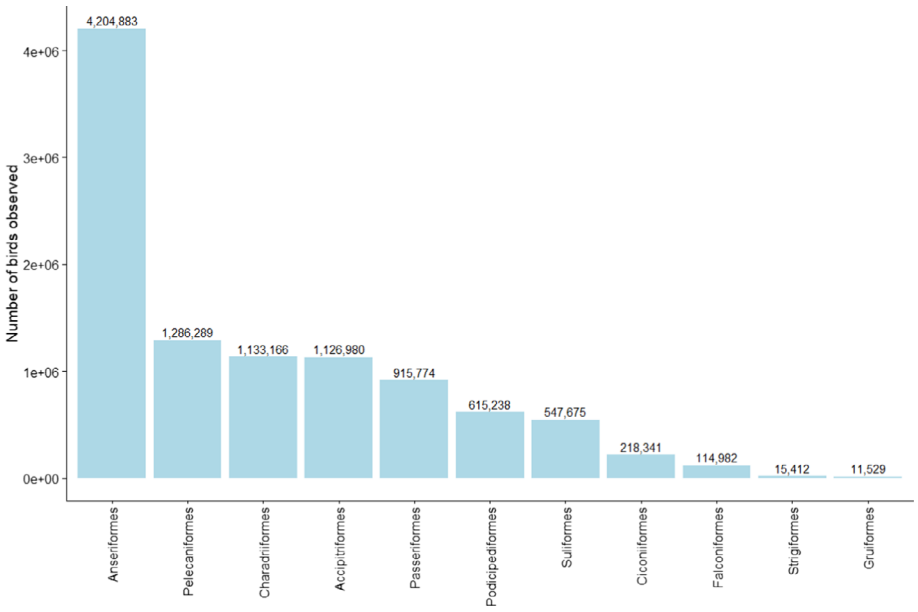

Figure F.2: Number of wild birds from the EFSA list of target wild bird species (n = 50) observed in 2019 and recorded in the EuroBirdPortal project, aggregated by bird order

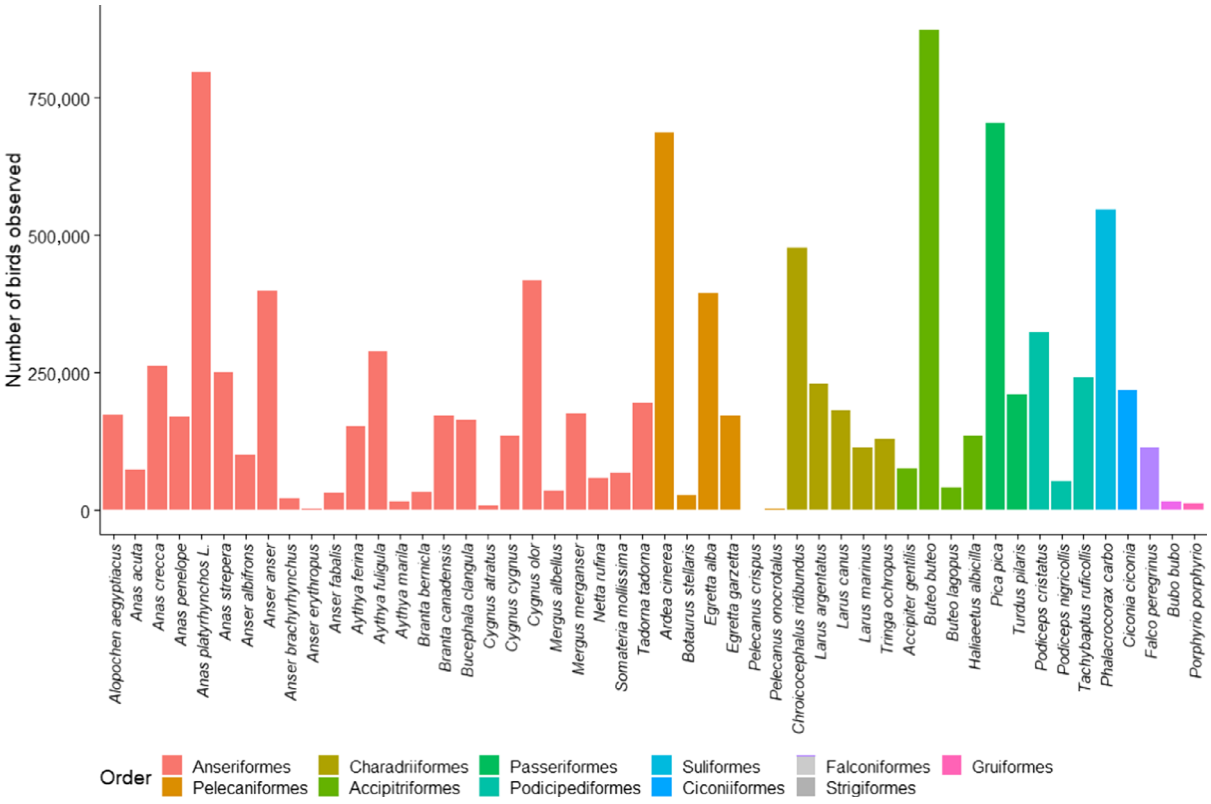

Figure F.3: Number of wild birds from the EFSA list of target wild bird species (n = 50) observed in 2019 and recorded in the EuroBirdPortal project, aggregated by bird species

Appendix G – Country Data sets

All country data sets containing the tables on the occurrence of avian influenza per country are available on the EFSA Knowledge Junction community on ZENODO – please see below the list and corresponding link to the data sets. The countries that submitted data sets on the 2019 surveillance data year are: the 28 EU Member States and 3 non-EU Member.

Table G.1: Links to the avian influenza data sets for 2019 by reporting country

Country	Link to the data set
EU Member States	
AT	https://zenodo.org/10.5281/zenodo.4285953
BE	https://zenodo.org/10.5281/zenodo.4285962
BG	https://zenodo.org/10.5281/zenodo.4285965
CY	https://zenodo.org/10.5281/zenodo.4285969
CZ	https://zenodo.org/10.5281/zenodo.4285972
DE	https://zenodo.org/10.5281/zenodo.4285974
DK	https://zenodo.org/10.5281/zenodo.4285977
EE	https://zenodo.org/10.5281/zenodo.4285979
EL	https://zenodo.org/10.5281/zenodo.4285983
ES	https://zenodo.org/10.5281/zenodo.4285985
FI	https://zenodo.org/10.5281/zenodo.4285990
FR	https://zenodo.org/10.5281/zenodo.4285992
HR	https://zenodo.org/10.5281/zenodo.4285994
HU	https://zenodo.org/10.5281/zenodo.4285998
IE	https://zenodo.org/10.5281/zenodo.4286003
IT	https://zenodo.org/10.5281/zenodo.4286005
LV	https://zenodo.org/10.5281/zenodo.4286009
LU	https://zenodo.org/10.5281/zenodo.4286011
LT	https://zenodo.org/10.5281/zenodo.4286014
MT	https://zenodo.org/10.5281/zenodo.4286016
NL	https://zenodo.org/10.5281/zenodo.4286018
PL	https://zenodo.org/10.5281/zenodo.4286021
PT	https://zenodo.org/10.5281/zenodo.4286023
RO	https://zenodo.org/10.5281/zenodo.4286025
SI	https://zenodo.org/10.5281/zenodo.4286027
SE	https://zenodo.org/10.5281/zenodo.4286029
SK	https://zenodo.org/10.5281/zenodo.4286033
UK	https://zenodo.org/10.5281/zenodo.4286035
Non-EU Member States	
CH	https://zenodo.org/10.5281/zenodo.4286039
IS	https://zenodo.org/10.5281/zenodo.4286042
NO	https://zenodo.org/10.5281/zenodo.4286044