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# Annual report on surveillance for avian influenza in poultry and wild birds in Member States of the European Union in 2021

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## Abstract

European Union (EU) Member States (MSs) are required to carry out surveillance for avian influenza (AI) in poultry and wild birds and notify the results to the responsible authority. In addition, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) also implement ongoing surveillance programmes to monitor incursions of avian influenza viruses (AIVs) in poultry and wild birds. EFSA received a mandate from the European Commission to collate, validate, analyse and summarise the data resulting from these AI surveillance programmes in an annual report. The present report summarises the results of the surveillance activities carried out in MSs and the aforementioned countries in 2021. Overall, 24,290 poultry establishments (PEs) were sampled, of which 27 were seropositive for influenza A(H5) and 4 for A(H7) viruses. Seropositive PEs were found in 10 MSs and, as per previous years, the highest percentages of seropositive PEs were found in establishments raising waterfowl game birds and breeding geese. Out of these 31 seropositive PEs, 3 tested positive by polymerase chain reaction (PCR) for influenza A(H5) viruses: 1 for highly pathogenic avian influenza virus (HPAIV), 1 for low pathogenic avian influenza virus (LPAIV) and 1 with unknown virus pathogenicity. In addition, 16 countries reported PCR test results from 1,858 PEs which did not correspond to the follow-up testing of a positive serology event (e.g. in some PEs, PCR tests were used for screening). Sixty-five of these PEs in 10 MSs were found positive for AIVs. Apart from poultry, 31,382 wild birds were sampled, with 2,314 wild birds testing positive for HPAIVs by PCR. Twenty-two countries reported HPAIV-positive wild birds and most positive samples were identified as highly pathogenic avian influenza (HPAI) A(H5N8) virus. In addition, 328 wild birds tested positive for LPAIVs of the A(H5/H7) subtypes and 362 wild birds tested positive for non-A(H5/H7) subtype AIVs.

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## 1. Summary

The European Union (EU) Member States (MSs), Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland)<sup>1</sup> (together referred to as reporting countries, RCs) implement surveillance programmes to detect incursions of avian influenza viruses (AIVs) in poultry and wild birds, particularly migratory wild birds, which are considered the main source of introduction of AIVs into poultry establishments (PEs). The present report summarises the results of the EU co-funded surveillance activities conducted in 2021, which consisted of:

- serological surveys to monitor the circulation of AIVs (A(H5) and A(H7) subtypes) in poultry and follow-up testing of positive serology events by polymerase chain reaction (PCR) (active surveillance).
- detection of AIVs in wild birds found dead or moribund by PCR (passive surveillance).

In addition, some MSs reported results from PCR tests conducted in poultry as part of active surveillance which did not relate to the aforementioned follow-up testing (e.g. screening) and results of active surveillance activities performed by testing live and hunted wild birds.

It is important to note that risk-based sampling strategies used for AI surveillance may vary between countries. Therefore, comparisons of positivity rates between different groups, such as different poultry categories, presented in this report are not representative and relate to the specific surveillance samples only. Positivity rates cannot be extrapolated to the source populations, as sampling may have targeted higher-risk groups. Moreover, the targeting approach may be different between countries, between groups and between years.

Changes in prevalence or incidence may not be fully captured by risk-based surveillance programmes only. Therefore, the differences in AI incidence between countries observed in this report, both in poultry and wild birds, should be interpreted with caution. Direct comparisons between countries should be avoided.

### 1.1. Serological surveys in poultry

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

Figures on the size of the poultry population (e.g. the overall number of PEs) under surveillance in RCs were not available when writing the present report. In 2021, a total of 24,290 PEs were sampled, slightly less than the number of PEs sampled in the previous year. The total number of PEs sampled and reported in each RC ranged from 20 in Hungary to 5,144 in the Netherlands.

Seventeen poultry categories (Table A.1 in Appendix A) were created to summarise the surveillance results in the present report. None of them was fully covered and sampled by all RCs. However, laying hen (conventional and free-range), breeding chicken, fattening turkey and gallinaceous game bird establishments were sampled by at least 20 RCs each. Growers and Muscovy ducks were targeted by only three and two RCs, respectively. In terms of the number of PEs sampled, backyard flocks were the most frequently sampled poultry category ( $n = 4,683$ ), followed by conventional and free-range laying hens ( $n = 4,433$  and  $3,435$ , respectively).

A total of 31 PEs were seropositive for either influenza A(H5) or A(H7) viruses (hereinafter referred to as A(H5/H7) viruses), including 27 to A(H5) and 4 to A(H7) subtypes. The H5/H7 seropositivity rate (0.13%) was around half of the one observed in 2020 (0.21%). Ten countries reported A(H5)-seropositive PEs: Belgium, Bulgaria, Czechia, Denmark, Finland, France, Italy, Poland, Spain and Sweden. Spain and France also reported A(H7)-seropositive PEs. Italy, the Netherlands and Romania accounted for more than 60% of all reported PEs sampled, however, only one positive PE was found among those PEs. The 2021 results confirm an overall decreasing trend in the proportion of A(H5/H7)-seropositive establishments reported to EFSA since the 2016 HPAI A(H5Nx) outbreaks, with the significant exception of 2019. The number of A(H5)-seropositive PEs remained higher than the number of A(H7)-seropositive PEs, as per previous years.

<sup>1</sup> In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.

Similarly, waterfowl game birds and breeding geese were the poultry categories with the largest proportions of A(H5/H7)-seropositive establishments (7.9% and 3.5%, respectively). The proportion of A(H5/H7)-seropositive PEs was 2.8% in breeding duck establishments and below 1% in all other poultry categories. No positive PEs were found in the following poultry categories: breeding chickens, broilers (heightened risk), turkeys (fattening and breeding), growers and Muscovy ducks. While backyard flocks and laying hens (conventional and free-range) represented the most frequently tested poultry categories, only 3, 1 and 1 seropositive PEs were identified, respectively. May was the month with the highest seropositive rate, followed by December.

In addition, serological test results for other AIVs than A(H5/H7) subtypes were available for some PEs. However, due to the non-mandatory reporting of these subtypes, the results presented in this report are less likely to be representative. Moreover, 16 countries also reported PCR test results carried out as screening tests from 1,858 PEs. Sixty-five of these PEs were found positive for AIVs and were located in Belgium, Bulgaria, Estonia, Germany, Italy, Lithuania, Luxembourg, Norway, Romania and Slovakia. Only 16 PEs were positive for HPAI A(H5) viruses and were located in Bulgaria, Estonia, Germany and Norway.

In order to optimise the information provided by active surveillance in poultry, RCs are encouraged to report the link between seropositive PEs and the results of further follow-up sampling and/or testing carried out in the same or surrounding PEs. Finally, understanding the distribution and composition of the underlying poultry population will help to better evaluate the efficiency of the surveillance activities carried out at a European level.

## 1.2. Surveillance in wild birds

A total of 27 MSs, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) reported results from passive surveillance of AIVs in wild birds in 2021. Although non-mandatory, 12 countries also reported results from their active surveillance programmes. Surveillance in wild birds in most RCs is not based on representative sampling, which is why the results presented here cannot be extrapolated to the source populations. Comparisons are valid for the specific surveillance samples only and cannot be used to imply differences between species, between locations or between years.

Results were reported for a total of 31,382 wild birds, including 20,920 wild birds sampled by passive surveillance. Compared to 2020, the total number of wild birds sampled in 2021 was larger due to a greater contribution of passive surveillance. Within RCs, the numbers of wild birds sampled by passive surveillance ranged from 9 wild birds in Malta to 7,321 wild birds in Germany. As results from active surveillance programmes in wild birds are only reported to EFSA on a non-mandatory basis, the numbers presented in this report do not necessarily reflect the full extent of active surveillance activities conducted by the RCs.

The number of wild birds sampled by quarter was much larger in the first quarter of 2021, from January to March, compared to the rest of the year (43% of the total). The monthly distribution of sampling within RCs was highly variable. Only half of all wild birds sampled were fully identified at species level (16,615 birds). These wild birds belonged to 294 species distributed in 7 orders. The largest number of samples originated from wild birds of the order Anseriformes ( $n = 6,302$ ). The orders Passeriformes, Accipitriformes, Charadriiformes, Columbiformes, Pelecaniformes and Strigiformes were also sampled in large numbers ( $n > 1,000$  each). Forty-seven of the 50 species listed by EFSA as targets for HPAI surveillance (Table E.1 in Appendix E) were sampled in 2021. The proportion of wild birds belonging to these target species was 41.4% and 34.7% among passive and active surveillance samples, respectively.

A total of 3,098 wild birds tested positive for AIVs: 2,314 for HPAIVs and 784 for LPAIVs. The largest number of HPAIV detections were identified as HPAI A(H5N8) viruses (1,321 out of 2,314 HPAIV-positive wild birds). The three species with the largest proportions of HPAIV-positive wild birds were the mute swan (*Cygnus olor*), the barnacle goose (*Branta leucopsis*) and the common buzzard (*Buteo buteo*). In general, HPAIVs in wild birds were identified at higher numbers and in larger proportions than in previous years (878 and 1 HPAIV-positive wild birds reported in 2020 and 2019, respectively). HPAIV-positive wild birds were reported by 22 countries: Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, the Netherlands, Norway, Poland, Slovenia, Spain, Sweden, Switzerland and the United Kingdom (Northern Ireland).

HPAIV-positive wild birds were mostly detected during the first and last quarters of the year. These results are in accordance with the seasonal fluctuations of the widespread HPAI A(H5N8) epidemic

reported in Europe since late 2020, affecting both poultry and wild birds. The last major HPAI epidemic in Europe had been reported in 2016–2017. After a relatively low circulation of HPAIVs in Europe in 2018 and 2019, it appears that the risk significantly increased throughout the continent in late 2020 and remained high in the first quarter of 2021 before falling again in the following quarter. However, detection rates of HPAIVs increased again in the last quarter of 2021 after a typical seasonal low along the summer period.

The 784 LPAIV-positive wild birds were reported by 22 of the 31 RCs. Positivity rates were the lowest in spring (March to August), while most LPAIV-positive wild birds were detected from September onwards. Passive surveillance activities accounted for the majority of LPAIV detections (62%). Most LPAIV-positive wild birds belonged to the order Anseriformes, which was expected given that this order was the most frequently sampled order by both active and passive surveillance programmes.

This report also presents summary data of wild bird observations by voluntary contributors in RCs obtained from the EuroBird Portal (EBP).<sup>2</sup> Despite the limitations of such data, and until further spatial modelling of the abundance and distribution of wild birds in Europe is readily available, the maps presented in this report may help to shed some light on areas where wild birds of the species belonging to the EFSA target list (Table E.1 in Appendix E) may gather, supporting RCs in carrying out more targeted surveillance activities. Further maps of the distribution of the 50 target species and the numbers of samples taken by RCs for these target species by month and NUTS3 level have been provided in Zenodo (<https://doi.org/10.5281/zenodo.7053222>). Considering the seasonality associated with the circulation of AIVs, these maps may be of help in improving the timing of sampling for targeted surveillance activities.

## 2. Introduction

Since late 2020, several European countries have experienced severe outbreaks of AI in poultry, with the highest number of outbreaks reported in farmed ducks, due to the circulation of different HPAI A(H5) viruses in the EU. In addition to these HPAIVs identified over the years, LPAIVs of both A(H5/H7) (not classified as HPAIVs) and other subtypes are continuously isolated from both poultry and wild birds. In order to implement appropriate measures to prevent incursions of AIVs and control the spread of the disease when incursions occur, MSs have implemented surveillance programmes in poultry and wild birds, including serological and virological surveillance activities. These activities include sampling of biological materials from different origins, detection of AIVs by various laboratory methods and typing of different antigenic subtypes based on their surface glycoproteins: haemagglutinin (H) and neuraminidase (N). The development and implementation of these surveillance programmes is currently supported by Regulation (EU) 2016/429<sup>3</sup>, which lays down the rules related to the EU surveillance programme for avian influenza, with Commission Delegated Regulation (EU) 2020/689<sup>4</sup> providing the technical requirements, such as objectives, scope and methodological principles.

### 2.1. Background and Terms of Reference

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<sup>5</sup>, from 2019 onwards, EFSA was requested to provide technical and scientific assistance to the EC to deliver on this mandate. This implies that EFSA has been responsible for producing the annual surveillance report on AI since 2020. In addition, the collation of all data related to the surveillance activities taking place in MSs has been conducted by EFSA in a harmonised way since January 2019.

<sup>2</sup> Available online: <https://eurobirdportal.org/ebp/en/#home/HIRRUS/r52weeks/CUCCAN/r52weeks/>

<sup>3</sup> 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, pp. 1–208.

<sup>4</sup> Commission Delegated Regulation (EU) 2020/689 of 17 December 2019 supplementing Regulation (EU) 2016/429 of the European Parliament and of the Council as regards rules for surveillance, eradication programmes, and disease-free status for certain listed and emerging diseases. OJ L 174, 3.6.2020, pp. 211–340.

<sup>5</sup> Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, pp. 1–24.

## 3. Results

### 3.1. Poultry

#### 3.1.1. Number of poultry establishments sampled

Twenty-seven MSs, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland), here referred to as RCs, reported results from their serological surveillance activities in 2021. Data on the total number of PEs present in RCs and the distribution of poultry categories within RCs were not available for this report. Therefore, the numbers of samples per poultry category reported below do not include information on the proportion of the population sampled in each RC and poultry category.

A total of 24,290 PEs<sup>6</sup> 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 numbers of sampling events taking place in all PEs and on distinct dates for a specific poultry category (see Section 5 for further details). Thus, the numbers of distinct PEs where sampling was performed may be lower than the total numbers of PEs sampled mentioned in this report (i.e. some PEs may have been sampled more than once). Such definition of PEs was important, as not all RCs are submitting surveillance data in a non-aggregated manner.

Surveillance in RCs varied in both the numbers of PEs sampled and the poultry categories targeted for surveillance (Figure 1). Some countries conducted testing in a limited number of poultry categories only (e.g. backyard flocks), while others distributed their sampling efforts over a larger number of poultry categories. An overview of the total numbers 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 for which the largest numbers of samples were taken, backyard flocks as well as conventional and free-range laying hens were the 3 most frequently sampled poultry categories (Figure 1). In addition, Figure 1 also shows the most frequently targeted poultry categories (i.e. tested by the largest number of RCs). There were 5 categories for which surveillance results were reported by at least 20 RCs: laying hens (conventional and free-range), breeding chickens, fattening turkeys and gallinaceous game birds. Only 3 and 2 countries reported sample collection from growers<sup>7</sup> and Muscovy ducks, respectively. Between 10 and 17 countries reported surveillance results for the remaining poultry categories (broilers at heightened risk, breeding turkeys, breeding and fattening ducks, breeding and fattening geese, backyard flocks, waterfowl game birds, ratites and others).

The mapping between the 17 reporting categories used in this report and the detailed reporting categories (for consistency with previous reports) is presented in Appendix A (Tables A.1 and A.2).

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<sup>6</sup> Throughout this report, 'number of PEs sampled' refers to all PEs sampled, regardless of the type of tests conducted on the samples (serology or virology).

<sup>7</sup> For the purpose of this report, growers are defined as PEs (different species) in which poultry are reared for only part of their production cycle, while they will later be sold to other farms for the completion of their production cycle (i.e. meat/eggs) (EFSA, 2018).

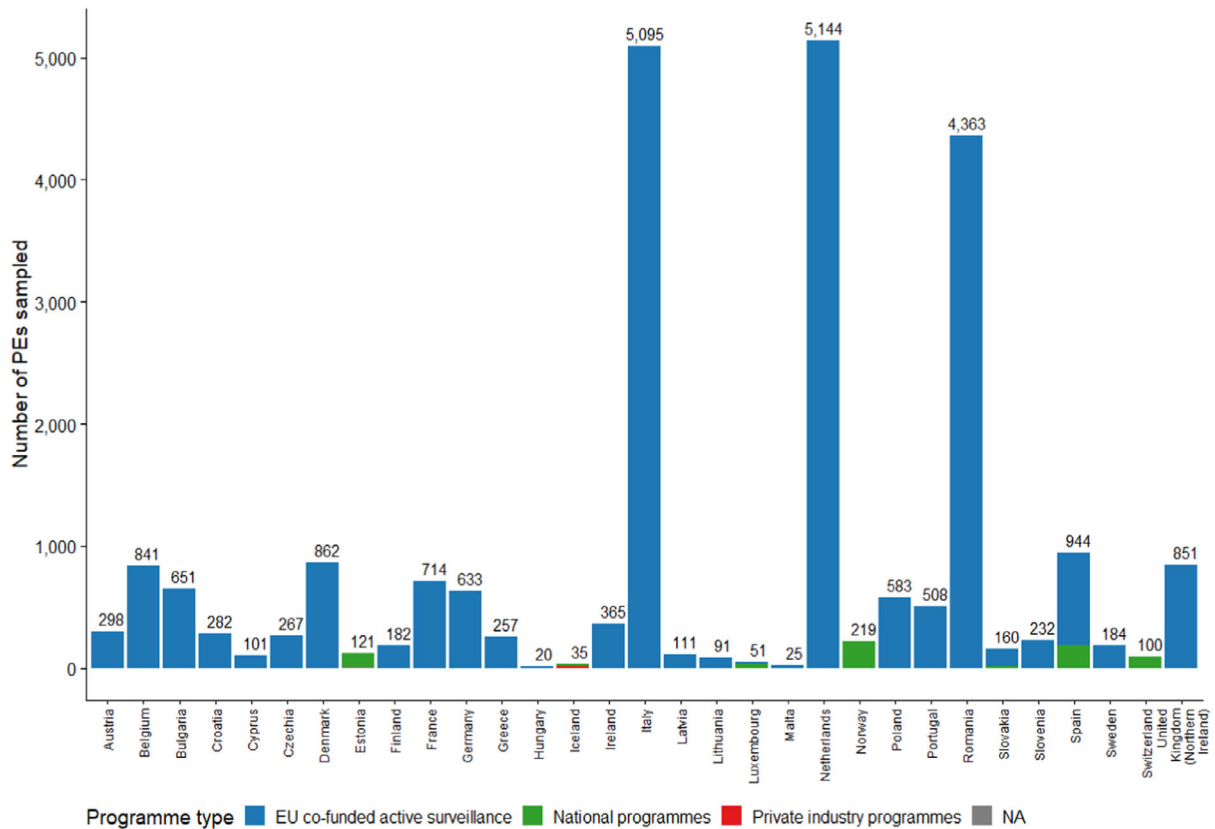
|                                   | Laying Hens | Free-Range Laying Hens | Breeding Chickens | Broilers (Heightened Risk) | Breeding Turkeys | Fattening Turkeys | Breeding Ducks | Fattening Ducks | Breeding Geese | Fattening Geese | Growers | Backyard Flocks | Muscovy Ducks | Game Birds (Gallinaceous) | Game Birds (Waterfowl) | Ratites | Others |
|-----------------------------------|-------------|------------------------|-------------------|----------------------------|------------------|-------------------|----------------|-----------------|----------------|-----------------|---------|-----------------|---------------|---------------------------|------------------------|---------|--------|
| Austria                           | 68          | 61                     | 46                |                            |                  | 53                |                | 24              |                | 35              |         |                 |               |                           |                        | 11      |        |
| Belgium                           | 176         | 292                    | 207               |                            |                  | 51                |                | 12              |                |                 |         | 77              |               | 26                        |                        |         |        |
| Bulgaria                          | 119         |                        |                   | 5                          |                  |                   |                | 1               |                |                 |         | 7               |               | 4                         |                        |         | 515    |
| Croatia                           | 45          | 37                     | 16                |                            | 1                | 29                | 2              |                 |                |                 |         | 151             |               |                           |                        |         | 1      |
| Cyprus                            | 24          | 12                     | 7                 | 3                          |                  | 2                 |                |                 |                |                 |         | 49              |               |                           |                        |         |        |
| Czechia                           | 50          | 24                     |                   |                            |                  | 43                | 29             | 49              | 9              | 16              |         |                 |               | 34                        | 13                     |         |        |
| Denmark                           |             | 451                    | 220               | 62                         |                  | 34                |                | 16              |                | 3               |         |                 |               | 68                        | 8                      |         |        |
| Estonia                           |             |                        |                   |                            |                  |                   |                |                 |                |                 |         |                 |               | 4                         |                        |         | 117    |
| Finland                           | 56          | 35                     | 34                | 1                          | 3                | 34                |                |                 | 1              |                 |         |                 |               | 12                        | 3                      | 3       |        |
| France                            | 42          | 56                     | 55                |                            | 40               | 28                | 77             | 254             | 29             | 53              |         |                 |               | 60                        | 20                     |         |        |
| Germany                           | 50          | 74                     | 10                | 19                         | 13               | 137               | 14             | 144             | 8              | 131             |         |                 |               | 3                         | 14                     | 16      |        |
| Greece                            | 60          | 45                     | 51                | 27                         | 1                | 24                |                |                 |                |                 | 37      |                 |               | 12                        |                        |         |        |
| Hungary                           |             |                        |                   | 1                          |                  |                   |                |                 | 1              |                 |         |                 | 16            |                           |                        |         | 2      |
| Iceland                           | 8           | 1                      | 18                |                            | 4                | 4                 |                |                 |                |                 |         |                 |               |                           |                        |         |        |
| Ireland                           | 12          | 56                     | 82                | 113                        | 1                | 74                |                | 19              |                | 2               |         |                 |               | 2                         |                        |         | 4      |
| Italy                             | 995         | 182                    | 253               |                            | 66               | 1,098             | 10             | 83              | 8              | 14              | 2,214   | 120             |               | 30                        |                        | 22      |        |
| Latvia                            | 34          |                        |                   |                            |                  |                   |                |                 |                |                 |         |                 | 72            |                           |                        |         | 5      |
| Lithuania                         | 21          |                        |                   |                            |                  | 6                 |                | 2               |                |                 |         |                 |               |                           |                        |         | 62     |
| Luxembourg                        | 4           | 8                      |                   | 3                          |                  |                   |                |                 |                |                 |         | 30              |               |                           |                        | 6       |        |
| Malta                             | 24          | 1                      |                   |                            |                  |                   |                |                 |                |                 |         |                 |               |                           |                        |         |        |
| Netherlands                       | 1,311       | 1,723                  | 883               | 999                        |                  | 144               | 43             | 39              |                |                 |         |                 |               | 2                         |                        |         |        |
| Norway                            | 75          |                        | 78                |                            | 5                | 50                | 3              |                 | 1              | 1               |         |                 |               |                           |                        |         | 6      |
| Poland                            | 80          | 37                     | 60                |                            | 20               | 60                | 28             | 82              | 82             | 82              |         |                 |               | 30                        |                        | 22      |        |
| Portugal                          | 114         | 66                     | 79                | 54                         |                  | 62                | 4              | 35              |                |                 |         | 59              |               | 31                        | 1                      | 3       |        |
| Romania                           | 762         |                        | 218               |                            |                  | 110               |                |                 |                |                 |         | 3,237           |               | 19                        | 1                      | 9       | 7      |
| Slovakia                          | 76          |                        | 18                |                            | 9                | 14                |                |                 | 2              | 1               |         | 15              | 3             | 8                         |                        | 4       | 10     |
| Slovenia                          | 44          | 47                     | 7                 |                            |                  | 33                |                | 96              |                |                 |         |                 |               | 4                         | 1                      |         |        |
| Spain                             | 113         | 51                     | 223               | 23                         | 9                | 56                | 1              | 81              | 1              | 23              |         | 77              |               | 177                       | 68                     | 19      | 22     |
| Sweden                            | 57          | 47                     | 28                | 3                          | 3                | 14                |                | 4               |                | 2               |         |                 | 1             | 8                         | 10                     | 7       |        |
| Switzerland                       | 13          |                        | 60                |                            |                  | 27                |                |                 |                |                 |         |                 |               |                           |                        |         |        |
| United Kingdom (Northern Ireland) |             | 69                     |                   |                            |                  |                   |                |                 |                |                 | 9       | 773             |               |                           |                        |         |        |

For Czechia, the correct numbers of PEs sampled are: 28 PEs for Breeding Ducks, 8 PEs for Breeding Geese and 10 PEs for Game Birds (Waterfowl).

**Figure 1:** Total number of PEs sampled, presented by RC and poultry category, according to 17 poultry categories. The colours are used to indicate the poultry categories with the smallest (lightest blue shade) to the largest (darkest blue shade) number of PEs sampled within a given RC

In addition to the sampling carried out under European funding ('EU co-funded active surveillance' in Figure 2), 4 MSs also reported surveillance results from their national programmes (non-EU co-funded programmes) (Estonia, Luxembourg, Slovakia and Spain) (Figure 2). It must be highlighted that MSs are not obliged to report surveillance results from surveillance activities other than the EU co-funded active surveillance. Norway, Switzerland and Iceland reported results from their national programmes, with Iceland also reporting results obtained by private industry sampling.





For Czechia, the correct number of PEs sampled is 262.

**Figure 2:** Number of PEs sampled by RCs in 2021 according to the type of active surveillance programme for which results were reported to EFSA

### 3.1.2. Timing of sampling in poultry

In terms of timing of sampling in poultry, 52% of sampling took place in the second half of the year (July to December). All countries except one conducted sampling activities during both halves, while France concentrated all its sampling activities in the second half of the year. A total of 12,675 PEs were reported as sampled from July to December, while 11,615 PEs were reported as sampled from January to June 2021. Figure 3 shows the monthly distribution of sampling in poultry by RC.



**Figure 3:** Monthly number of PEs sampled by RCs in 2021, reflecting heterogeneity in sampling efforts. The scale of the vertical axes varies by RC

### 3.1.3. Avian influenza in poultry

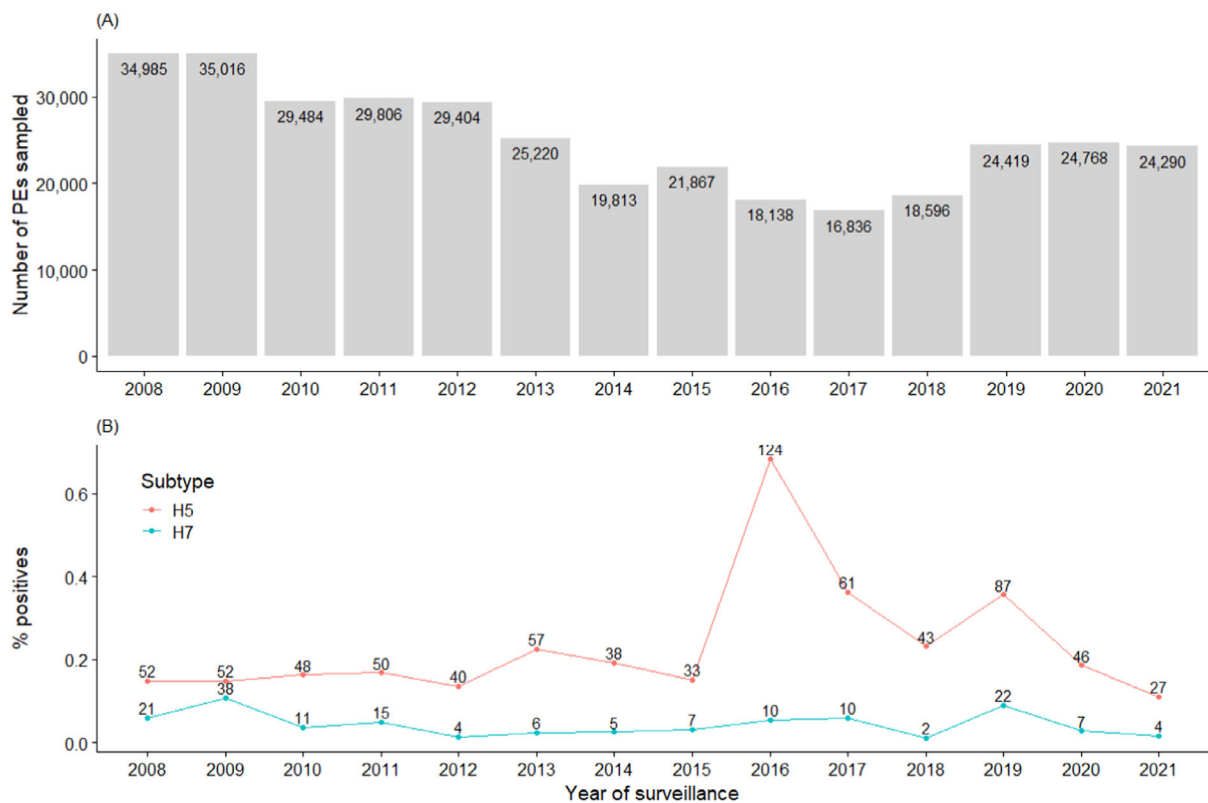
#### 3.1.3.1. Serological test results overview

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

- sampling targeted higher-risk groups (non-representative sampling strategy) in some RCs.
- the definition and prioritisation of higher-risk groups may differ between RCs, between groups and between years.

Therefore, the percentages provided in this report relate to the surveillance samples only. The underlying population cannot be used as denominator. Interpretations of temporal trends are based on the assumption that both sampling strategies and targeting remain constant in all RCs throughout the year.

In 2021, 27 and 4 PEs were seropositive for influenza A(H5) and A(H7) viruses, respectively (Figure 4). None of the PEs sampled tested positive for both influenza A(H5) and A(H7) viruses. The combined percentage of A(H5/H7)-seropositive PEs was 0.13%, which was lower than in 2020 (0.21%). The percentage of A(H5)-seropositive PEs was 0.11%, which decreased by almost half compared to the previous year (0.19% in 2020). The percentage of A(H7)-seropositive PEs was 0.02%, similar to the percentage found in 2020 (0.03%). In 2021, the total number of PEs sampled ( $n = 24,290$ ) was at a similar level as in 2020 and 2019, but it was still higher than the numbers of PEs sampled between 2014 and 2018 (Figure 4A).

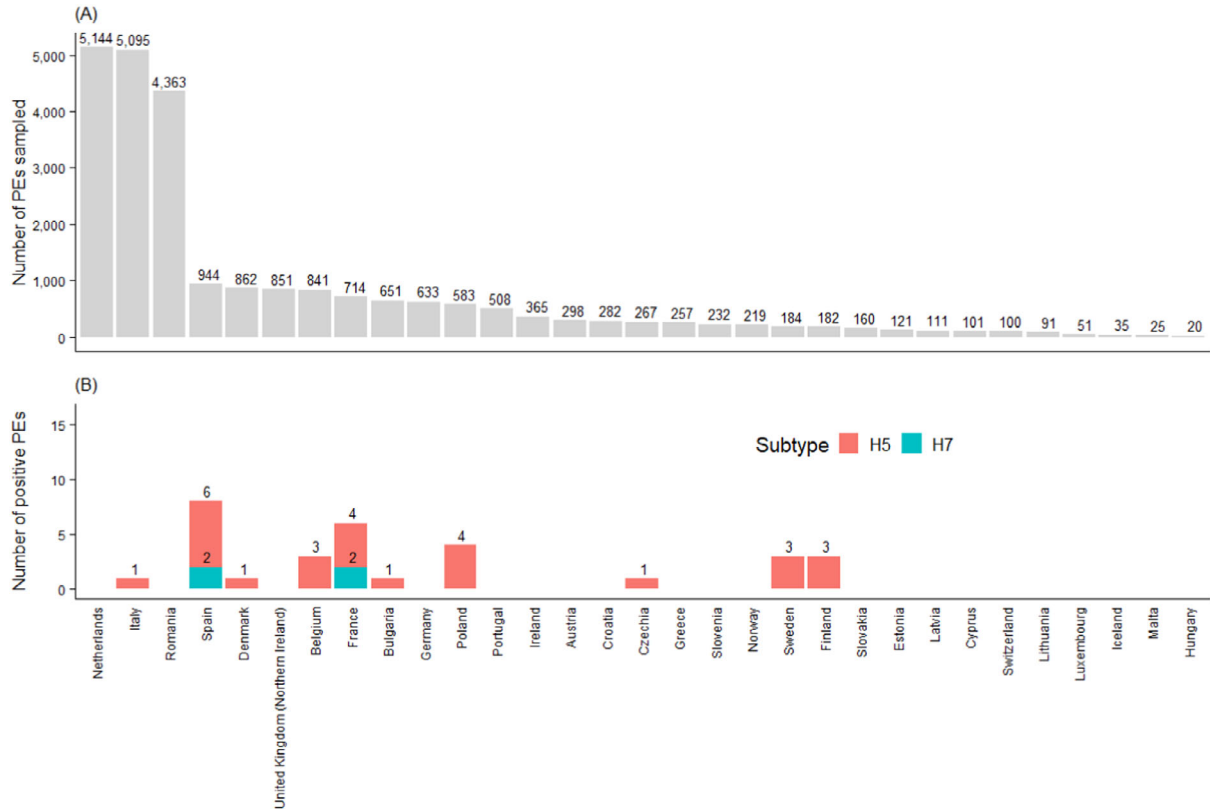


**Figure 4:** (A) Total number of PEs sampled per year and (B) line graph of the percentage of PEs seropositive for influenza A(H5/H7) viruses, with the number of seropositive PEs shown per year as labels

#### 3.1.3.2. Serological test results by reporting countries

As per previous years, considerable variation in the number of PEs sampled was observed among RCs in 2021 (Figure 5). As in 2020, three countries (Italy, the Netherlands and Romania) accounted for 60% of all PEs sampled during the course of 2021. Variations were also observed within RCs (Figure 6). The total number of PEs sampled ranged from 20 in Hungary to 5,144 in the Netherlands,

with the median number of PEs sampled in RCs being 267 (Figure 5). Between RCs, the numbers of A (H5/H7)-seropositive PEs varied only slightly. A total of ten RCs reported the detection of A(H5/H7)-seropositive PEs. All of these countries detected influenza A(H5) viruses (a total of 27 PEs), but influenza A(H7) viruses were only identified in Spain and France (a total of 4 PEs) (Figure 5). Only one positive PE was reported among the three RCs that as a group accounted for more than 60% of all PEs sampled.

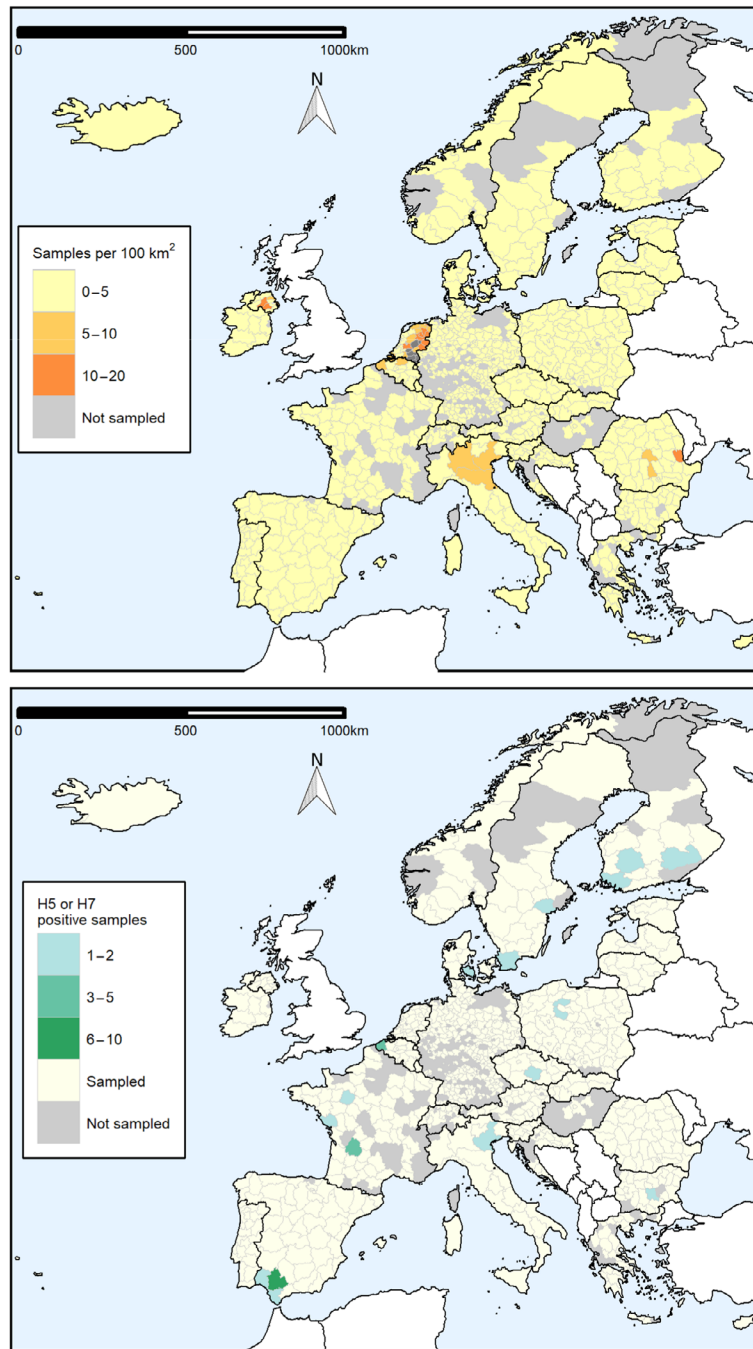


For Czechia, the correct number of PEs sampled is 262.

**Figure 5:** (A) Total number of PEs sampled in 2021 shown per RC in descending order and (B) total number of seropositive PEs found by subtype

### 3.1.3.3. Serological test results by administrative unit

Surveillance activities in poultry were reported for 30 NUTS2 (Nomenclature of Territorial Units for Statistics, level 2) and 750 NUTS3 units in 2021. Reporting at NUTS2 level was linked to surveillance activities in Belgium, Germany, Italy and the United Kingdom (Northern Ireland). Out of the 24,290 PEs sampled, 5,924 and 18,366 were reported at NUTS2 and NUTS3 levels, respectively. Out of the 31 seropositive PEs, 4 and 27 were reported at NUTS2 and NUTS3 levels, respectively. Figure 6 shows the geographical distribution of surveillance activities and the numbers of A(H5/H7)-seropositive PEs in 2021. Data are presented at the NUTS level of reporting (i.e. maps show a combination of NUTS2 and NUTS3 units). The sampling density, estimated as the number of PEs sampled per 100 km<sup>2</sup> within a NUTS region, and distribution of A(H5/H7)-seropositive PEs are presented in Figure 6 in the upper and lower maps, respectively.



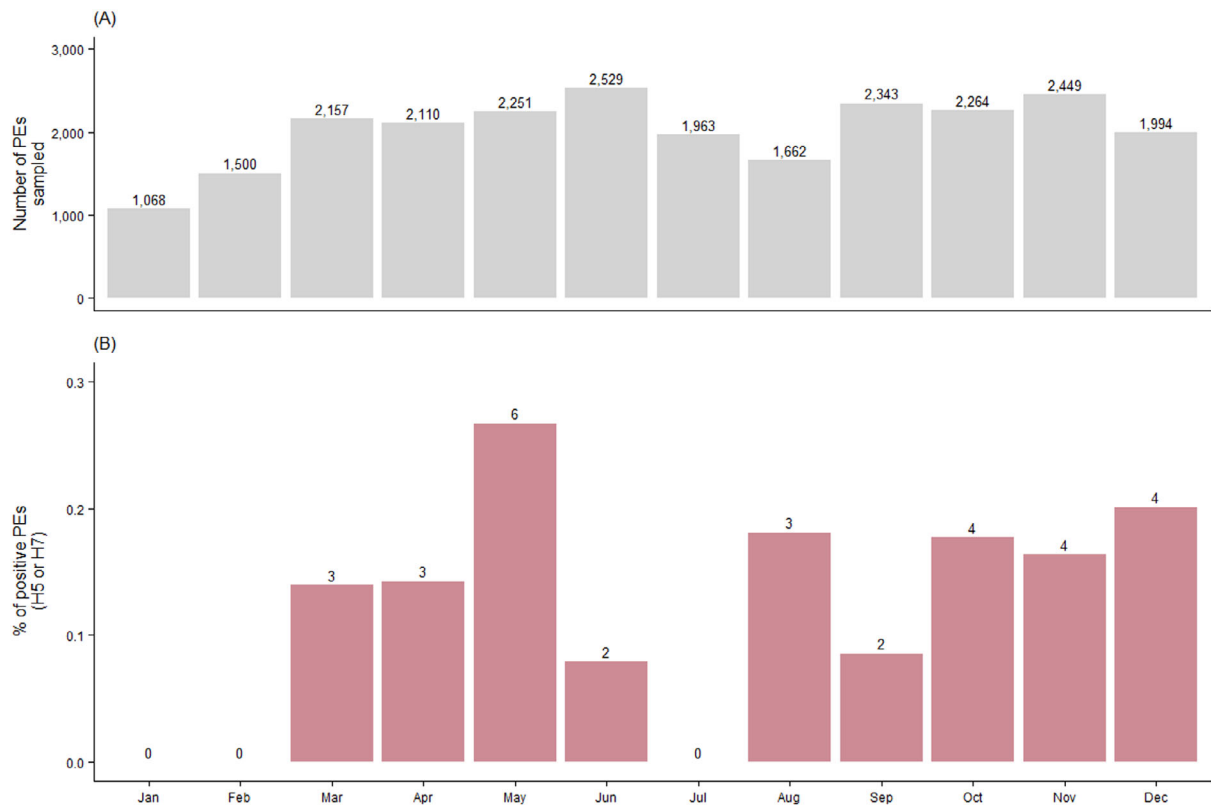
**Figure 6:** Sampling density, expressed as the number of PEs sampled per 100 km<sup>2</sup> (upper map), and geographical distribution of A(H5/H7)-seropositive PEs (lower map) by administrative unit. Non-reporting countries are shown in white

#### 3.1.3.4. Serological test results by month

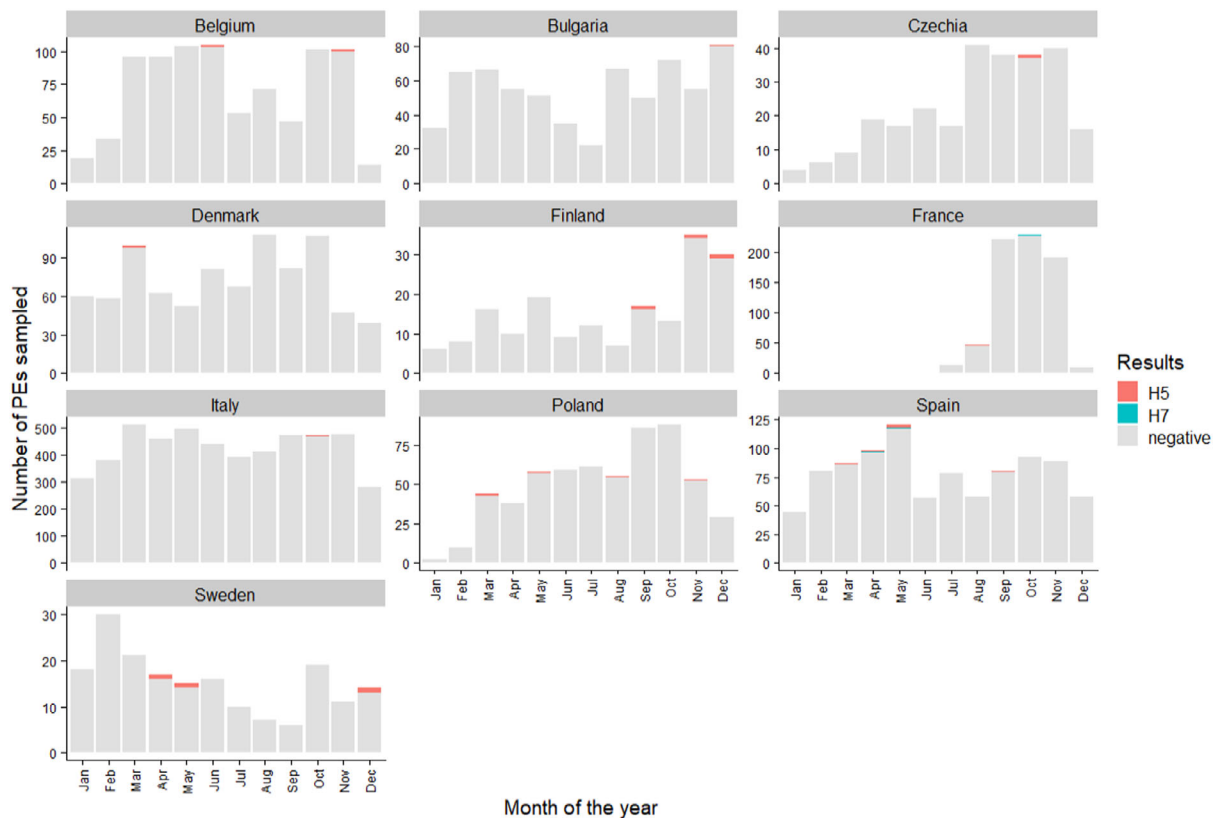
Since 2019, data on poultry surveillance have been reported on a monthly basis. The distribution of PEs testing positive for influenza A(H5/H7) viruses by month shows that the months with the largest proportions and highest numbers of A(H5/H7)-seropositive PEs were May and December 2021 (Figure 7). During these months, 6 and 4 PEs, respectively, were reported seropositive, compared to a number of 1 to 4 PEs during other months of the year. However, these differences do not appear to be significant. There was no apparent correlation between higher seropositivity rates and higher numbers of PEs sampled. However, as noted in the previous report, the month with the highest number of seropositive PEs corresponded to the month during which most of the PEs from the poultry category 'game birds (waterfowl)' were sampled. In 2020, this was the case in June, while in 2021, it occurred

in May (Figure 10): 56 PEs were sampled in May compared to 83 during the other 11 months. Out of 11 seropositive PEs in waterfowl game birds, 5 were identified in May.

For the 10 countries reporting A(H5/H7)-seropositive PEs, the distribution of these sampling events by month is shown in Figure 3.8 (Figure 8).



**Figure 7:** (A) Total number of PEs sampled by month with values above bars referring to the number of PEs sampled. (B) percentage (y-axis) and number (above bars) of PEs sampled that tested seropositive for influenza A(H5/H7) viruses by month



**Figure 8:** Monthly numbers of PEs sampled and seropositive for influenza A(H5/H7) viruses in 2021, presented for RCs with at least one A(H5/H7)-seropositive PE only. The scale of the vertical axes is specific to each country

### 3.1.3.5. Serological test results by poultry category

The highest numbers of PEs sampled by RCs in 2021 were from the backyard and conventional laying hen categories ( $n = 4,683$  and  $3,435$ , respectively) (Figure 9A). These most frequently sampled categories were the same as in previous years. Other categories sampled in high numbers were free-range laying hens, breeding chickens, growers and fattening turkeys (Figure 9B).

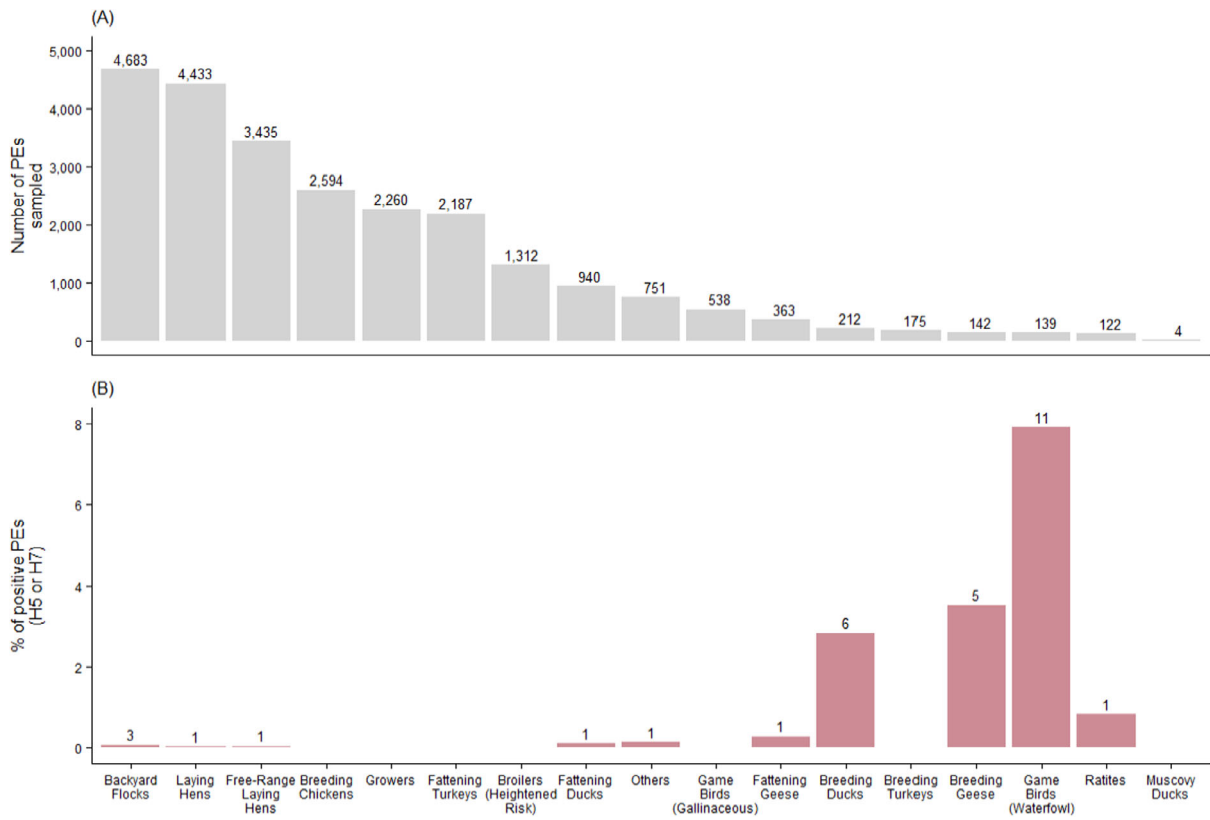
In 2021, as in 2020 and earlier, the highest percentage of A(H5/H7)-seropositive PEs was found in the waterfowl game bird category (7.9% out of 139 waterfowl game bird PEs sampled), followed by breeding geese (3.5% out of 142 PEs) and breeding ducks (2.8% out of 212 PEs). Proportions of seropositive PEs were below 1% for all other poultry categories. The fattening duck category had a lower proportion of seropositive PEs compared to the previous year (0.1% out of 940 PEs sampled). When considering only gallinaceous species, the highest percentage of A(H5/H7)-seropositive PEs was observed in the backyard flocks category (0.1% out of 4,683 PEs sampled). No A(H5/H7)-positive test results were found in breeding chickens, broilers (heightened risk), turkeys (fattening or breeding), growers and Muscovy ducks. One positive PE was found in the conventional laying hen category, unlike in 2020 when no positive PE had been reported for this poultry category.

In addition to A(H5/H7)-positive test results, 14 RCs reported positive test results for non-A(H5/H7) subtype AIVs<sup>8</sup> in poultry (Austria, Belgium, Czechia, Estonia, France, Germany, Iceland, Latvia, Luxembourg, Malta, the Netherlands, Norway, Spain and Sweden). There were 310 PEs seropositive for non-A(H5/H7) subtype AIVs, to which the free-range laying hen, breeding chicken, backyard flocks, conventional laying hen and fattening duck categories contributed the most. Proportions of PEs seropositive for non-A(H5/H7) subtype AIVs by poultry category may not be reliably estimated, as reporting of these subtypes is non-mandatory. Therefore, results for non-A(H5/H7) subtype AIVs are excluded from Figure 9.

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

<sup>8</sup> Reporting of non-A(H5/H7) subtype AIVs by MSs is non-mandatory.

that, regardless of the management system, seropositive PEs were found in Anseriformes (domestic and mallard ducks as well as geese and other Anseriformes), chickens and ratites. A large number of seropositive 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 bars referring to the number of PEs sampled, (B) percentage (y-axis) and number (above bars) of PEs sampled that tested seropositive for influenza A(H5/H7) viruses by poultry category





**Figure 10:** Monthly number of PEs sampled and seropositive for influenza A(H5/H7) viruses in 2021, presented by poultry category. The scale of the vertical axes is specific to each category. Some positive test results (e.g. in conventional laying hens) are not visible due to the low number of positive PEs during the respective months (e.g. 1 A(H5)-positive PE only). The asterisks indicate whether there was at least one positive PE reported for the respective category and month

### 3.1.3.6. Serological test results: summary

Figure 11 shows only RCs and poultry categories in which A(H5/H7)-seropositive PEs were detected in case there was at least one PCR-confirmed A(H5/H7)-positive PE. Spain, France and Poland were the countries reporting the most A(H5)-seropositive PEs. These PEs belonged mainly to waterfowl game birds in Spain, breeding ducks in France and breeding geese in Poland. Spain and France also reported the detection of A(H7)-seropositive PEs (waterfowl game birds and breeding ducks, respectively).

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



**Figure 11:** Number of PEs seropositive for influenza A(H5/H7) viruses by RC and poultry category in 2021, presented only for RCs and poultry categories with at least one PCR-confirmed A(H5/H7)-positive PE

### 3.1.3.7. PCR and virological test results

Out of the 31 PEs with positive serological tests for influenza A(H5/H7) viruses, samples from 24 PEs were further tested for AIV viral RNA using PCR, which resulted in 5 of these PEs testing also positive by PCR:

- 2 positive PEs for non-A(H5/H7) subtype LPAIVs in breeding ducks in France.
- 1 positive PE for the HPAI A(H5) subtype in waterfowl game birds in Denmark.
- 1 positive PE for the LPAI A(H5) subtype in breeding geese in Czechia.
- 1 PE for influenza A(H5) virus (virus pathogenicity unknown) in the 'other' poultry category in Bulgaria.

Most of the seropositive PEs were tested by PCR on the same day ( $n = 16$ ), while the remainder were re-sampled for PCR testing on average 12 days after the serological tests. No virus isolation (VI) results were available for the PEs with positive serological or PCR tests. VI results were available for samples from 1 PE in Belgium and were positive for non-A(H5/H7) subtype LPAIVs.

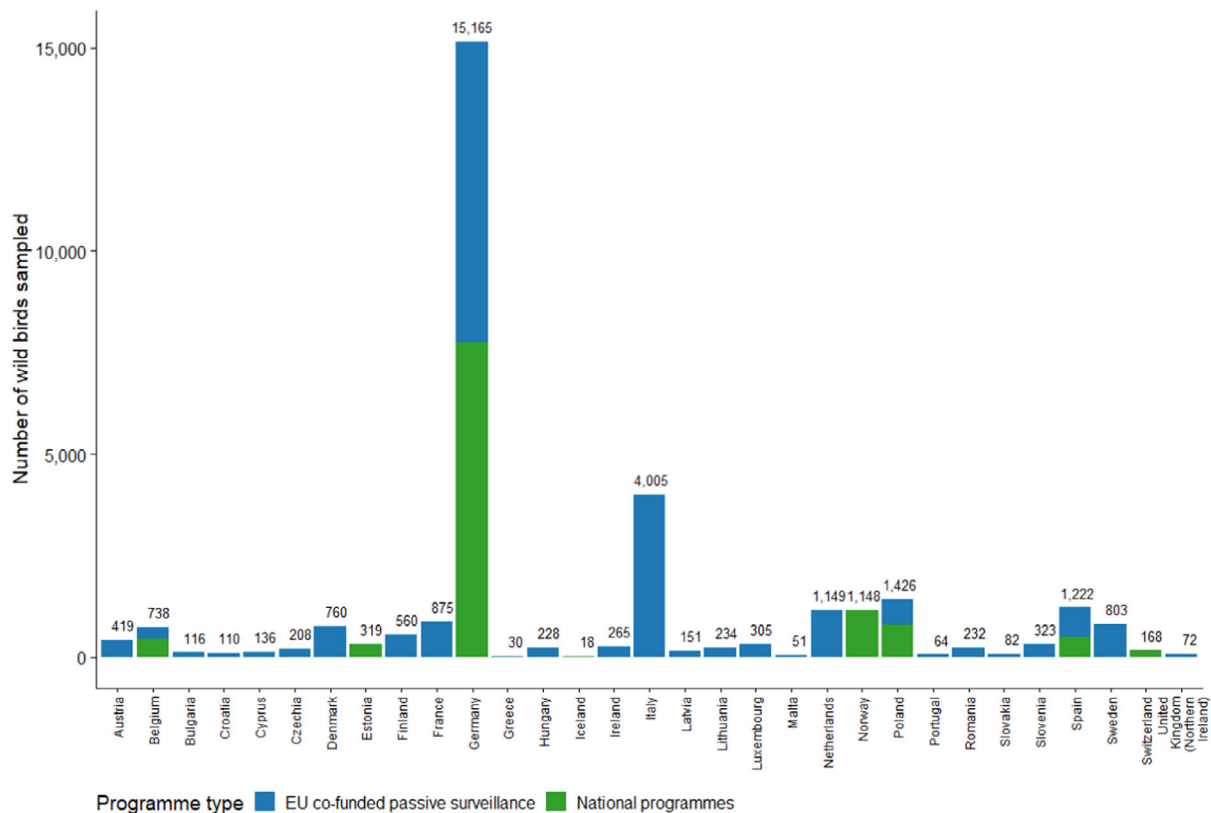
In addition, 16 countries also reported PCR results from 1,858 PEs which did not correspond to the follow-up testing of a positive serology event (e.g. in some PEs, PCR tests were used for screening). Sixty-five of these PEs were found positive for AIVs. These PCR-positive PEs were located in Belgium, Bulgaria, Estonia, Germany, Italy, Lithuania, Luxembourg, Norway, Slovakia and Romania. Among these, only 16 PEs were PCR-positive for HPAI A(H5) viruses and were located in Bulgaria, Estonia, Germany and Norway.

### 3.2. Wild birds

#### 3.2.1. Number of wild birds sampled

In 2021, a total of 31,382 wild birds were sampled by 27 MSs, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) (31 RCs) either by active or passive surveillance.

In addition to the sampling carried out under European funding ('EU co-funded passive surveillance' in blue in Figure 12), 5 MSs reported surveillance results from their national programmes (non-EU co-funded programmes) (Belgium, Estonia, Germany, Poland and Spain). It must be highlighted that MSs are not obliged to report surveillance results from surveillance activities other than the EU co-funded passive surveillance. Norway, Switzerland and Iceland reported results from their national programmes.



**Figure 12:** Number of wild birds sampled by RCs in 2021 according to the type of surveillance programme

For the purpose of this report, wild birds 'found dead' or 'live with clinical signs' were classified under passive surveillance (the latter including injured wild birds), while wild birds reported as 'hunted with clinical signs', 'hunted without clinical signs' and 'live without clinical signs' were considered as wild birds sampled by active surveillance. This is consistent with the classification method followed in previous reports. Active surveillance is assumed to be undertaken by voluntary contributors, as MSs are not obliged to report results from active surveillance in wild birds.

All 31 RCs reported results from their passive surveillance programmes in 2021. Of the total number of wild birds sampled, 20,920 were sampled by passive surveillance, which is more than in the past 3 years (e.g.  $n = 12,418$  in 2020) (Table 1). The sensitivity of passive surveillance for AI in wild

birds is highly dependent on the probability of contributors discovering and reporting wild birds found dead, injured or with clinical signs.

Some RCs (n = 12) also performed and reported results from active surveillance (non-EU co-funded programmes for which reporting is non-mandatory), particularly, Belgium, Germany, Malta, Norway and Poland, which sampled a higher number of wild birds by active than passive surveillance (Table 1). Although active surveillance was carried out in other countries as well, the data shown in this report represent only the data that were submitted to EFSA. As reporting of results from active surveillance in wild birds to EFSA is non-mandatory, the numbers reported below do not represent the full extent of active surveillance activities conducted by some of the countries. Consequently, this report contains complete data for passive surveillance only and focuses mainly on summarising the sampling activities and results obtained by passive surveillance.

**Table 1:** Number of wild birds sampled by RCs in 2021 (light grey background), with active and passive surveillance presented separately and combined as a total, and the number of wild birds sampled by passive surveillance from 2018 to 2021 (no background colour). In case of low numbers or no data reported for active surveillance, the respective RC may have reported only little data to EFSA or not carried out active surveillance at all

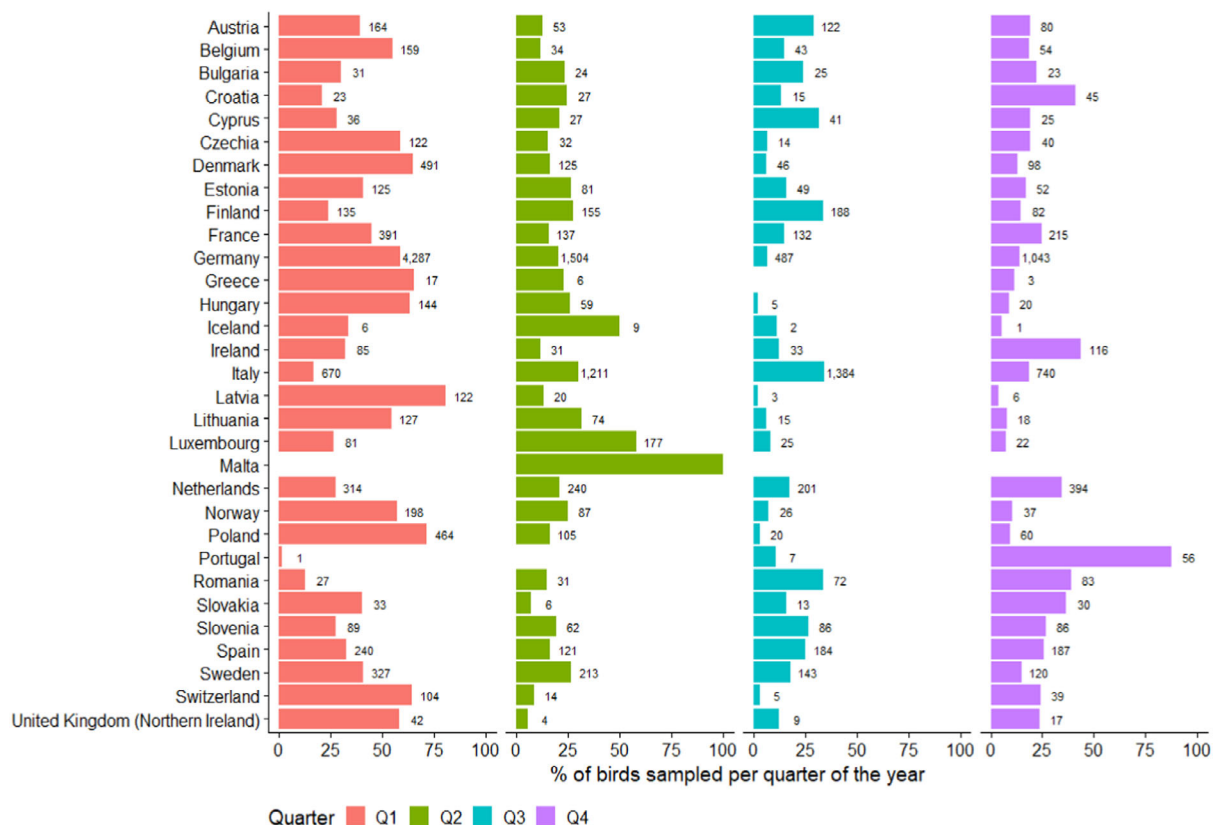
| Reporting country                 | Passive surveillance |              |               |               | Active surveillance (2021) | Total (2021)  |
|-----------------------------------|----------------------|--------------|---------------|---------------|----------------------------|---------------|
|                                   | 2018                 | 2019         | 2020          | 2021          |                            |               |
| Austria                           | 109                  | 85           | 183           | 419           | 0                          | 419           |
| Belgium                           | 237                  | 423          | 275           | 290           | 448                        | 738           |
| Bulgaria                          | 58                   | 65           | 70            | 103           | 13                         | 116           |
| Croatia                           | 223                  | 160          | 92            | 110           | 0                          | 110           |
| Cyprus                            | 109                  | 87           | 137           | 129           | 7                          | 136           |
| Czechia                           | 94                   | 104          | 127           | 208           | 0                          | 208           |
| Denmark                           | 148                  | 111          | 288           | 760           | 0                          | 760           |
| Estonia                           | 16                   | 8            | 3             | 307           | 12                         | 319           |
| Finland                           | 195                  | 174          | 222           | 560           | 0                          | 560           |
| France                            | 113                  | 158          | 503           | 875           | 0                          | 875           |
| Germany                           | 1,711                | 1,392        | 3,041         | 7,321         | 7,844                      | 15,165        |
| Greece                            | 13                   | 12           | 6             | 26            | 4                          | 30            |
| Hungary                           | 371                  | 338          | 472           | 228           | 0                          | 228           |
| Iceland                           | –                    | 2            | 9             | 18            | 0                          | 18            |
| Ireland                           | 142                  | 78           | 165           | 265           | 0                          | 265           |
| Italy                             | 2,109                | 2,719        | 2,791         | 4,005         | 0                          | 4,005         |
| Latvia                            | 14                   | 15           | 4             | 151           | 0                          | 151           |
| Lithuania                         | 70                   | 63           | 139           | 234           | 0                          | 234           |
| Luxembourg                        | –                    | 50           | 135           | 305           | 0                          | 305           |
| Malta                             | –                    | –            | 9             | 9             | 42                         | 51            |
| Netherlands                       | 663                  | 643          | 878           | 1,149         | 0                          | 1,149         |
| Norway                            | –                    | 28           | 128           | 348           | 800                        | 1,148         |
| Poland                            | 36                   | 33           | 97            | 649           | 777                        | 1,426         |
| Portugal                          | 82                   | 126          | 74            | 64            | 0                          | 64            |
| Romania                           | 244                  | 201          | 107           | 213           | 19                         | 232           |
| Slovakia                          | 84                   | 45           | 83            | 82            | 0                          | 82            |
| Slovenia                          | 178                  | 231          | 270           | 323           | 0                          | 323           |
| Spain                             | 344                  | 281          | 437           | 732           | 490                        | 1,222         |
| Sweden                            | 455                  | 456          | 410           | 803           | 0                          | 803           |
| Switzerland                       | 45                   | 30           | 55            | 162           | 6                          | 168           |
| United Kingdom                    | 1,282                | 816          | 1,208         | –             | –                          | –             |
| United Kingdom (Northern Ireland) | –                    | –            | –             | 72            | 0                          | 72            |
| <b>Total</b>                      | <b>9,145</b>         | <b>8,934</b> | <b>12,418</b> | <b>20,920</b> | <b>10,462</b>              | <b>31,382</b> |

### 3.2.2. Timing of sampling in wild birds

In Figure 13, the quarterly distribution of the number of wild birds sampled by passive surveillance in 2021 is shown by RC. The highest numbers of samples were taken during the first quarter (January–March). The distribution of sampling was lower but relatively consistent during the following three quarters:

- quarter 1: 9,055 wild birds (43%);
- quarter 2: 4,678 wild birds (22%);
- quarter 3: 3,395 wild birds (16%);
- quarter 4: 3,792 wild birds (18%).

Figure 13 highlights variation among RCs in terms of the sampling distribution throughout the year (percentage of samples taken during each quarter by each RC). However, sampling was most intensive (over 25%) in the first quarter for most countries except Croatia, Finland, Italy, Malta, Portugal and Romania.



**Figure 13:** Quarterly percentage (bars) and total numbers (values) of wild birds sampled by passive surveillance by RCs in 2021, with the first quarter starting in January 2021

### 3.2.3. Species distribution in wild birds

Among wild birds sampled by passive surveillance, there were:

- 16,615 wild birds fully identified at species level. These samples belonged to a total of 294 wild bird species belonging to 25 orders.
- 3,683 wild birds for which only the genus was identified but not the species (14 orders).
- 271 wild birds for which only the family was identified but not the species (13 orders).
- 64 wild birds for which only the order was identified (7 orders).
- 287 wild birds for which species identification information was completely missing. Wild birds in this category are shown as 'Species unknown' in Figure 14.

The most frequently sampled order were Anseriformes (n = 6,302), which accounted for 30.1% of the total number of wild birds sampled by passive surveillance. The orders Passeriformes,

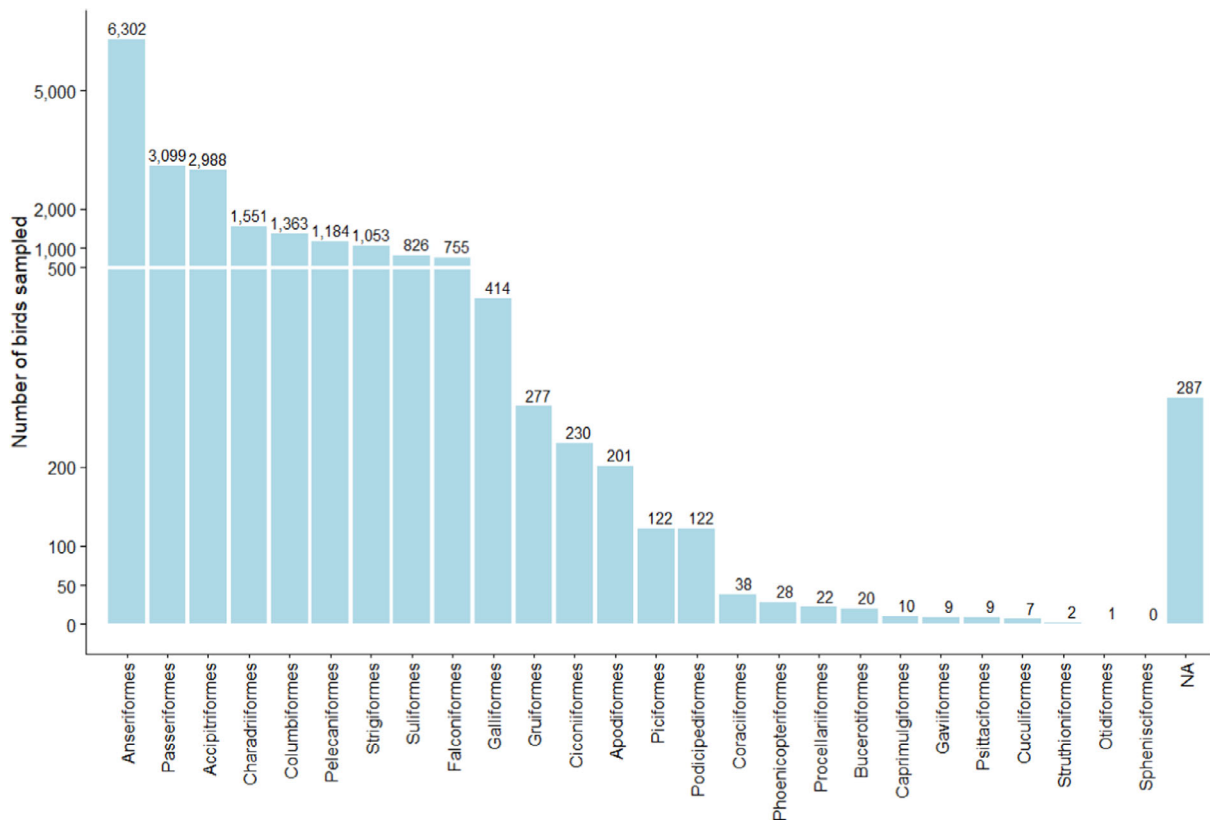
Accipitriformes, Charadriiformes, Columbiformes, Pelecaniformes and Strigiformes were also sampled in high numbers ( $n > 1,000$  each) (Figure 14).

Also most active surveillance samples were taken from wild birds of the order Anseriformes. A total of 7,136 samples from this order were tested by active surveillance, out of a total of 10,462 samples tested (68.2%). The distribution of wild birds sampled by order is shown for active and passive surveillance combined in Figure C.1 in Appendix C.

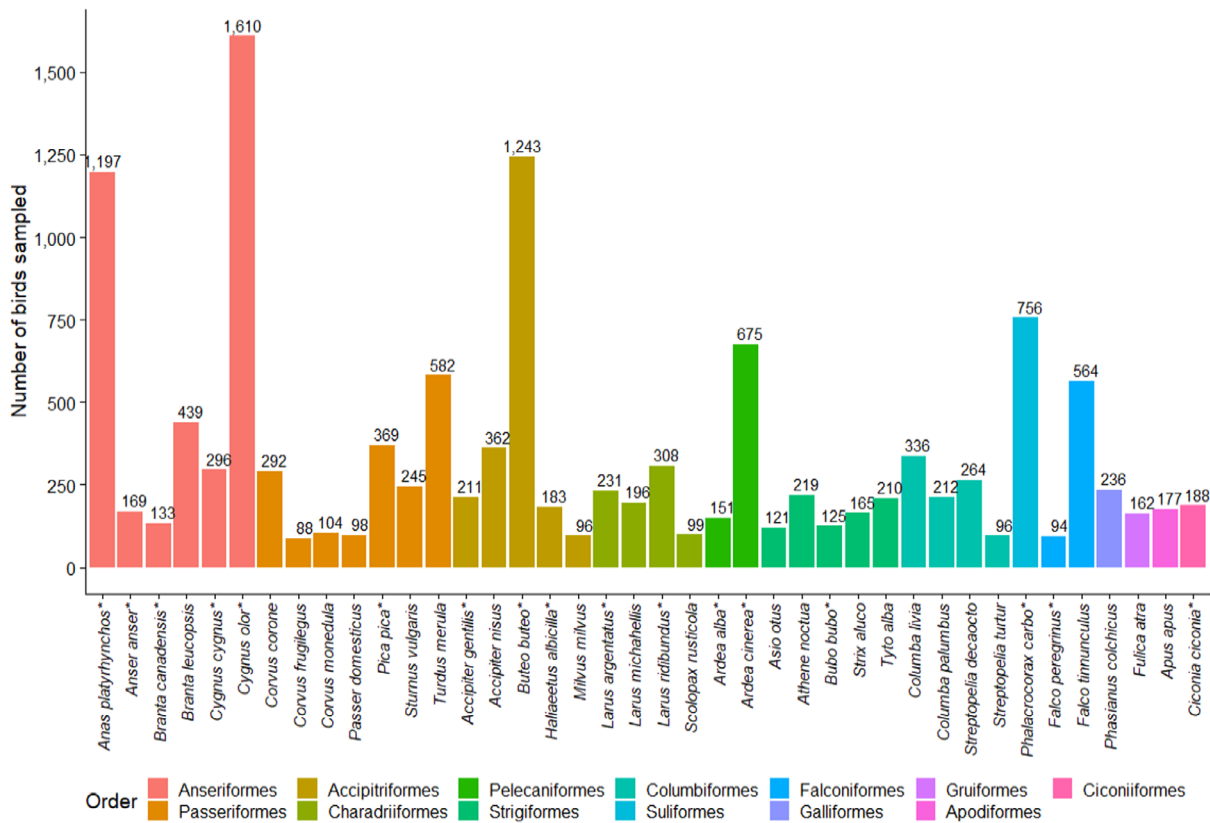
The majority (approximately 60%) of the species sampled by passive surveillance belonged to the orders Passeriformes ( $n = 72$ ), Anseriformes ( $n = 43$ ), Charadriiformes ( $n = 42$ ) and Accipitriformes ( $n = 29$ ). In Figure 15, the 40 species (out of 294 fully identified species) with the most sampled wild birds in 2021 are shown.

The 3 most sampled species by passive surveillance were the mute swan (*Cygnus olor*), the common buzzard (*Buteo buteo*) and the mallard duck (*Anas platyrhynchos*), consistent with the 2020 results, albeit in a different order. The fourth most sampled species in 2020 was the common pigeon (*Columba livia*), which was not among the top 10 most sampled species in 2021. All English common names for the species shown in Figure 15 are listed in Table D.1 in Appendix D.

Forty-seven out of the 50 target species recommended by EFSA for HPAI surveillance are included in the 294 species reported (Table E.1 in Appendix E). A total of 41.3% and 34.7% of the wild birds sampled by passive and active surveillance belonged to these target species, respectively ( $n = 8,648$  and 3,634, respectively).



**Figure 14:** Total number of wild birds of the different orders, sampled by passive surveillance in 2021 ( $n = 20,920$ ). The y-axis is presented on a non-linear scale to improve visibility



**Figure 15:** Total numbers of wild birds sampled for the 40 most sampled wild bird species reported by passive surveillance in 2021 (13,302 wild birds out of 16,615 fully identified wild birds). The bar colours refer to the bird orders. The asterisks indicate the wild bird species belonging to the 50 target species recommended by EFSA for HPAI surveillance. English common names for the species shown are provided in Table D.1 in Appendix D

### 3.2.4. Avian influenza in wild birds

#### 3.2.4.1. Detection of avian influenza viruses in samples

When analysing data from both active and passive surveillance, a total of 3,098 (9.9%) wild birds, out of the 31,382 sampled by RCs, tested positive for AIVs (Table 2). This proportion was slightly higher than in 2020 (8,6%) and twice as high as in 2019 (4.7%). Of the 3,098 AIV-positive wild birds, 2,314 were infected with HPAIVs and 784 with LPAIVs.<sup>9</sup>

In 2021, the majority of AIV-positive wild birds were found by passive surveillance (87%), as in 2020 but different from 2019 (i.e. in 2019, 7% of AIV infections were detected by passive surveillance). Most AIV-positive wild birds were found dead (n = 2,616, including 2,144 HPAIV-positive wild birds). The proportions of HPAIV-positive wild birds in active and passive surveillance were 1% and 11%, respectively, indicating a higher mortality involved.

<sup>9</sup> For some AIV-positive wild birds, one or more samples tested positive for HPAIVs, while virus pathogenicity results were not available for at least one of the other samples. These birds were therefore considered as HPAIV-positive in the present report.

**Table 2:** Test results for wild birds sampled by passive (no background colour) and active (light grey background) surveillance by RCs in 2021, presented by wild bird status. All VI-positive wild birds (column 'Positive by VI') had previously tested positive by PCR

|                | Wild bird status              | No. of wild birds sampled | No. of AIV-positive wild birds |                |                |                |
|----------------|-------------------------------|---------------------------|--------------------------------|----------------|----------------|----------------|
|                |                               |                           | Positive by PCR or VI          | Positive by VI | HPAIV-positive | LPAIV-positive |
| <b>Active</b>  | Hunted with clinical signs    | 94                        | 18                             | 0              | 15             | 3              |
|                | Hunted without clinical signs | 2,186                     | 181                            | 0              | 39             | 142            |
|                | Live without clinical signs   | 8,182                     | 198                            | 12             | 40             | 158            |
|                | <i>Subtotal</i>               | <i>10,462</i>             | <i>397</i>                     | <i>12</i>      | <i>94</i>      | <i>303</i>     |
| <b>Passive</b> | Found dead                    | 20,095                    | 2,616                          | 42             | 2,144          | 472            |
|                | Live with clinical signs      | 825                       | 85                             | 0              | 76             | 9              |
|                | <i>Subtotal</i>               | <i>20,920</i>             | <i>2,701</i>                   | <i>42</i>      | <i>2,220</i>   | <i>481</i>     |
| <b>Total</b>   |                               | <b>31,382</b>             | <b>3,098</b>                   | <b>54</b>      | <b>2,314</b>   | <b>784</b>     |

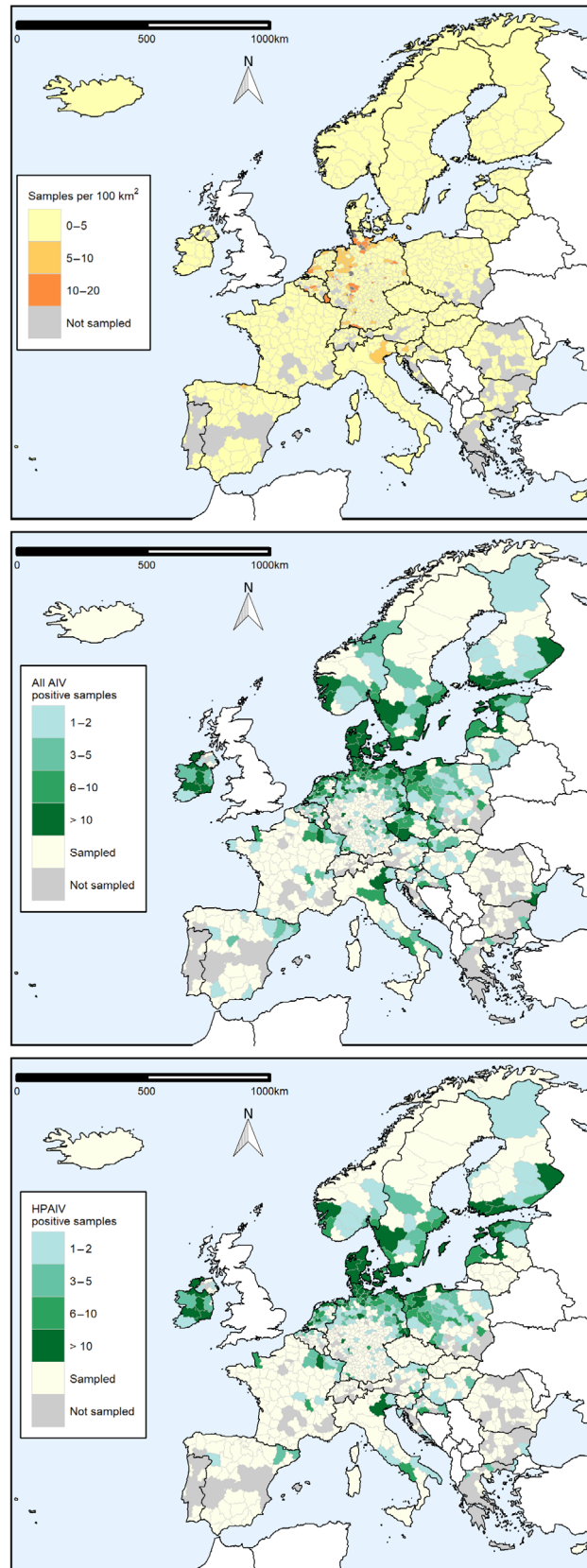
Wild bird sampling was reported for 21 NUTS2 units, 220 NUTS3 units and 19,476 individual coordinate locations in 2021. Italy reported surveillance results at NUTS2 level, while Czechia, Hungary, Ireland, Lithuania, Malta, Poland, Romania and Spain reported results at NUTS3 level. Latvia, Luxembourg and the Netherlands reported some results at NUTS3 level and some for individual location coordinates. Other countries reported results with location coordinates only.

Out of the 31,382 wild birds sampled, 4,005 and 4,609 were reported at NUTS2 and NUTS3 levels, respectively, while 22,768 were reported for individual location coordinates. Out of the 2,314 HPAIV-positive (A(H5/H7) subtypes) wild birds, 21 and 401 were reported at NUTS2 and NUTS3 levels, respectively, while 1,892 were reported for individual location coordinates.

Figure 16 shows the geographical distribution of surveillance activities in wild birds conducted by RCs in 2021. Data are presented at the NUTS level of reporting (i.e. maps show a combination of NUTS2 and NUTS3 units). Data reported with location coordinates were aggregated at NUTS3 level.

Larger numbers of AIV- and HPAIV-positive samples coincided with larger sampling densities (Figure 16).



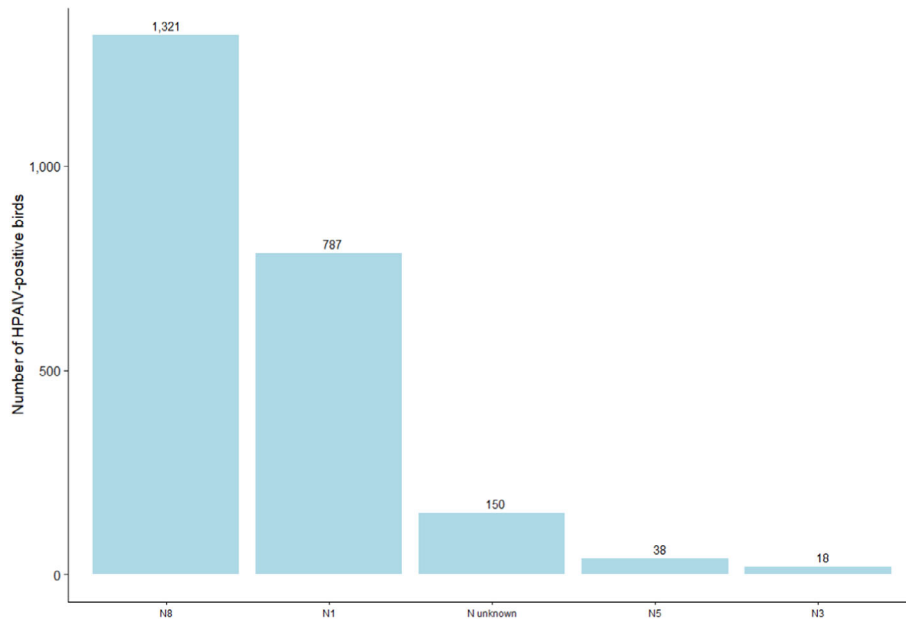


**Figure 16:** Sampling density, expressed as the numbers of wild birds sampled per 100 km<sup>2</sup> (upper map), and geographical distribution of all AIV- (middle map) and HPAIV-positive (lower map) wild birds by administrative unit. Non-reporting countries are shown in white

### 3.2.4.2. Highly pathogenic avian influenza in wild birds

#### 3.2.4.2.1. Highly pathogenic avian influenza results by neuraminidase type

A total of 2,314 wild birds in 22 RCs tested positive for HPAIVs in 2021, more than in 2020 ( $n = 878$ ) and 2019 ( $n = 1$ ). All of these HPAIVs were classified as belonging to the A(H5) subtype, and around half of them were identified as influenza A(H5N8) virus (57%). Figure 17 summarises the N subtypes identified for these samples.



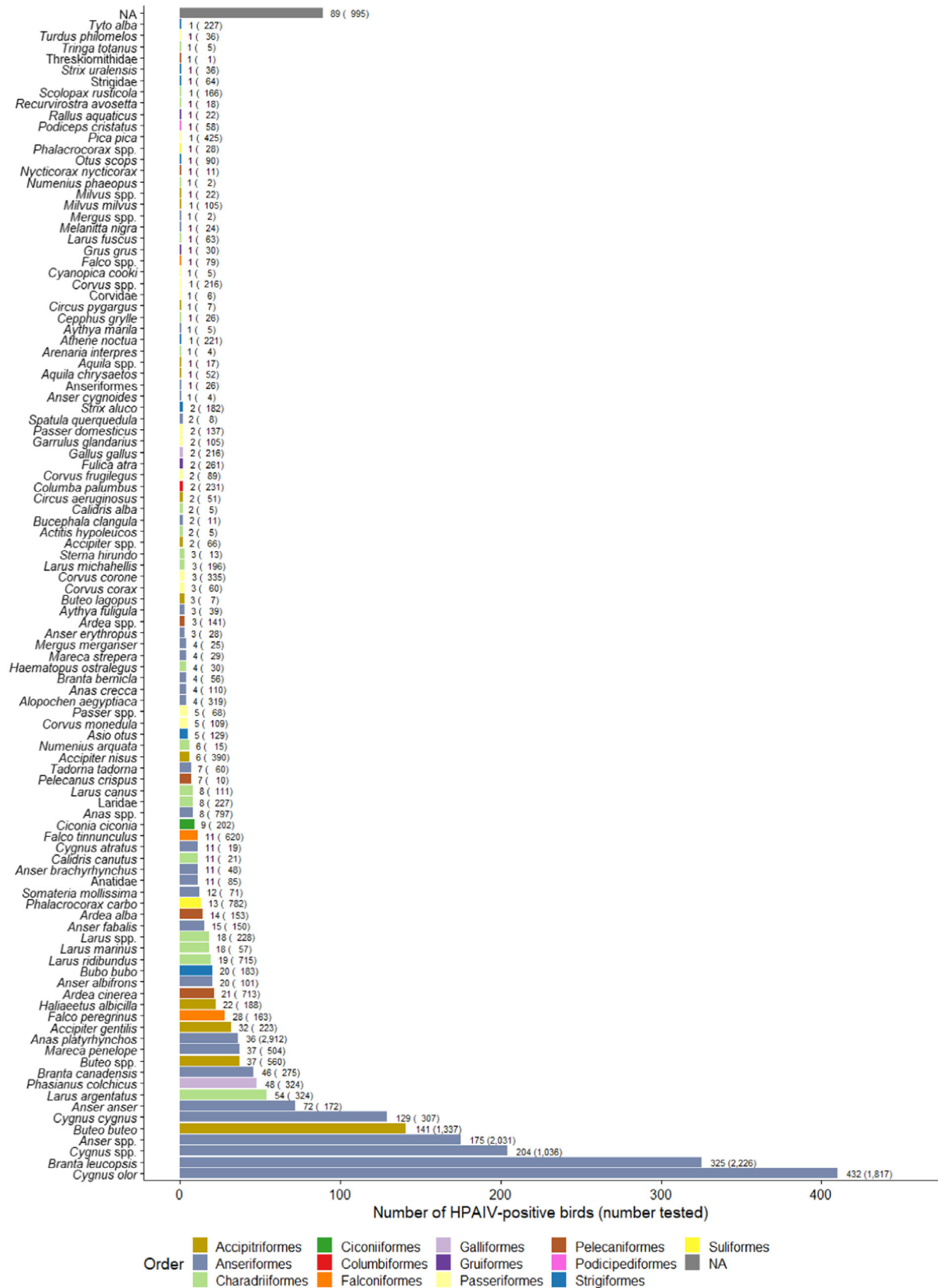
**Figure 17:** AIV neuraminidase (N) subtypes identified for HPAIV-positive wild birds (all HPAIVs were classified as belonging to the A(H5) subtype). Values are provided above bars. There were no wild birds with more than one N subtype identified

#### 3.2.4.2.2. Highly pathogenic avian influenza results by species

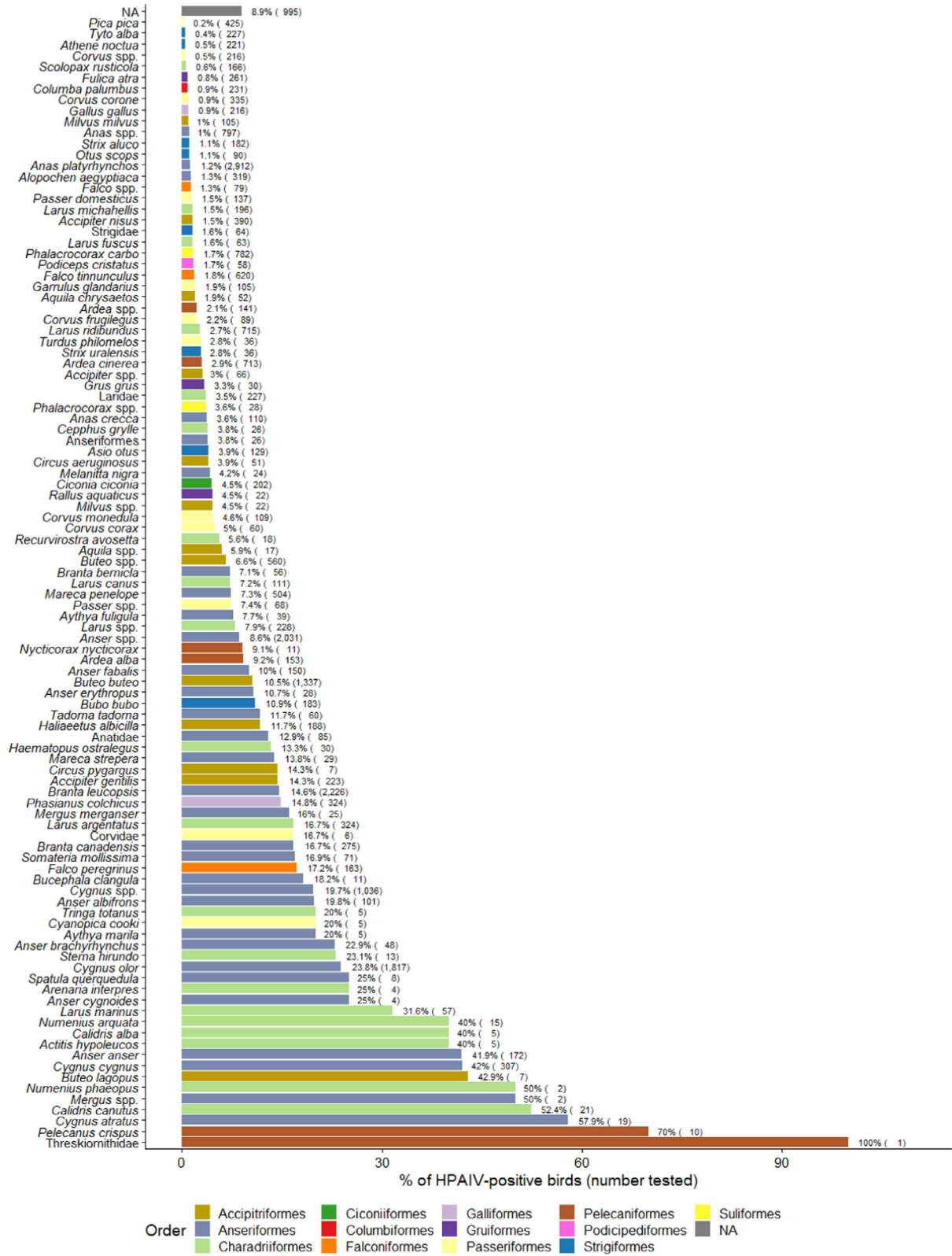
A total of 83 species, wild birds from 14 genera of unknown species, wild birds from 5 families of unknown species and 89 wild birds without species identification (no order, family, genus or species identified) were positive for HPAIVs. These HPAIV-infected wild birds belonged to at least 13 orders, as shown in Figures 18 and 19. These two figures show data from passive and active surveillance combined. The same data are presented separately by type of surveillance in Appendices G and H: Figures G.1 and G.2 (passive surveillance), and Figures H.1 and H.2 (active surveillance).

Half of the HPAIV-positive wild birds belonged to the target species recommended by EFSA for HPAI surveillance ( $n = 1,227$ , 53%) (Table E.1 in Appendix E). In particular, the species with the highest number of HPAIV-positive samples identified was the mute swan (*Cygnus olor*,  $n = 432$ ) (Figure 18). The two following species with the highest numbers of HPAIV-infected wild birds were the barnacle goose (*Branta leucopsis*,  $n = 325$ ), which is not listed as a target species, and the common buzzard (*Buteo buteo*,  $n = 141$ ). However, a large number of positive wild birds were identified only at the genus level (*Cygnus* spp.,  $n = 204$ , and *Anser* sp.,  $n = 175$ ).

The percentage of HPAIV-positive wild birds by species shown in Figure 19 should be interpreted with caution, as the number of wild birds sampled for a given species may be very low. For example, only one wild bird identified at the family level Threskiornithidae was sampled and tested positive, yielding a percentage of 100% for this respective family.



**Figure 18:** Number of HPAIV-positive wild birds detected by both passive and active surveillance, for species with at least one HPAIV-positive sample. The numbers of wild birds tested are indicated in brackets. Bars are ordered by increasing number of positive wild birds and colour-coded to identify the order to which species belong to. English common names are provided in Table D.1 in Appendix D.



**Figure 19:** Proportion of HPAIV-positive wild birds detected among wild birds tested by both passive and active surveillance, for species with at least one HPAIV-positive sample. The numbers of wild birds tested are indicated in brackets. Bars are ordered by increasing proportion of positive wild birds and colour-coded to identify the order to which species belong to. English common names are provided in Table D.1 in Appendix D

### 3.2.4.2.3. Highly pathogenic avian influenza results by type of surveillance

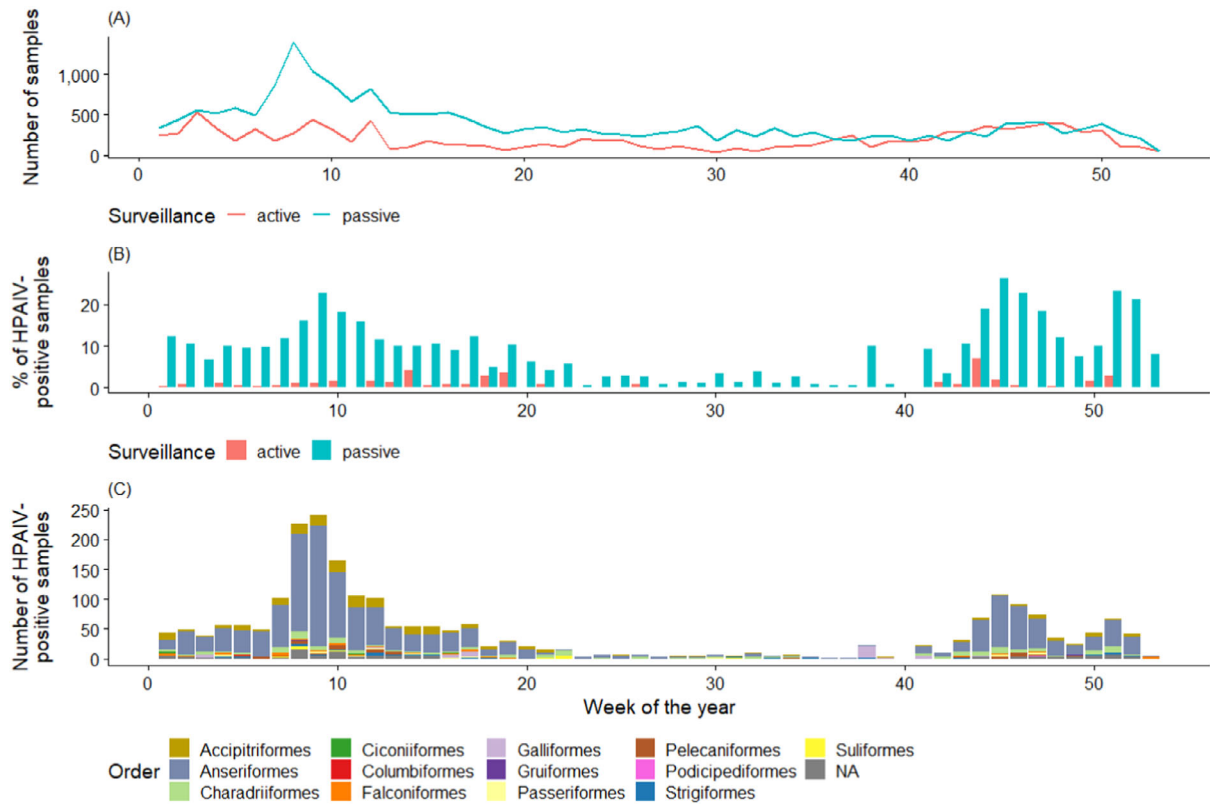
Table 3 shows the proportion of HPAIV-positive wild birds by type of surveillance. The highest percentages of HPAIV-positive wild birds by passive surveillance were found in Denmark (38.3% of samples), Latvia (32.5%), Greece (30.8%) and Poland (29.1%).

**Table 3:** Total numbers of wild birds sampled and positive for HPAIVs by passive and active surveillance in RCs. Cells with grey background indicate that no HPAIV-positive wild birds were detected in the respective RC by the respective surveillance activity

| Country                              | Passive surveillance |                                      | Active surveillance |                                      |
|--------------------------------------|----------------------|--------------------------------------|---------------------|--------------------------------------|
|                                      | No. of wild birds    | No. of HPAIV-positive wild birds (%) | No. of wild birds   | No. of HPAIV-positive wild birds (%) |
| Austria                              | 419                  | 44 (10.5%)                           | 0                   | –                                    |
| Belgium                              | 290                  | 24 (8.3%)                            | 448                 | 2 (0.4%)                             |
| Bulgaria                             | 103                  | 2 (1.9%)                             | 13                  | 0 (0%)                               |
| Croatia                              | 110                  | 19 (17.3%)                           | 0                   | –                                    |
| Cyprus                               | 129                  | 0 (0%)                               | 7                   | 0 (0%)                               |
| Czechia                              | 208                  | 0 (0%)                               | 0                   | –                                    |
| Denmark                              | 760                  | 291 (38.3%)                          | 0                   | –                                    |
| Estonia                              | 307                  | 52 (16.9%)                           | 12                  | 1 (8.3%)                             |
| Finland                              | 560                  | 94 (16.8%)                           | 0                   | –                                    |
| France                               | 875                  | 49 (5.6%)                            | 0                   | –                                    |
| Germany                              | 7,321                | 916 (12.5%)                          | 7,844               | 88 (1.1%)                            |
| Greece                               | 26                   | 8 (30.8%)                            | 4                   | 0 (0%)                               |
| Hungary                              | 228                  | 11 (4.8%)                            | 0                   | –                                    |
| Iceland                              | 18                   | 0 (0%)                               | 0                   | –                                    |
| Ireland                              | 265                  | 72 (27.2%)                           | 0                   | –                                    |
| Italy                                | 4,005                | 21 (0.5%)                            | 0                   | –                                    |
| Latvia                               | 151                  | 49 (32.5%)                           | 0                   | –                                    |
| Lithuania                            | 234                  | 0 (0%)                               | 0                   | –                                    |
| Luxembourg                           | 305                  | 0 (0%)                               | 0                   | –                                    |
| Malta                                | 9                    | 0 (0%)                               | 42                  | 0 (0%)                               |
| Netherlands                          | 1,149                | 169 (14.7%)                          | 0                   | –                                    |
| Norway                               | 348                  | 37 (10.6%)                           | 800                 | 3 (0.4%)                             |
| Poland                               | 649                  | 189 (29.1%)                          | 777                 | 0 (0%)                               |
| Portugal                             | 64                   | 0 (0%)                               | 0                   | –                                    |
| Romania                              | 213                  | 0 (0%)                               | 19                  | 0 (0%)                               |
| Slovakia                             | 82                   | 0 (0%)                               | 0                   | –                                    |
| Slovenia                             | 323                  | 11 (3.4%)                            | 0                   | –                                    |
| Spain                                | 732                  | 10 (1.4%)                            | 490                 | 0 (0%)                               |
| Sweden                               | 803                  | 139 (17.3%)                          | 0                   | –                                    |
| Switzerland                          | 162                  | 2 (1.2%)                             | 6                   | 0 (0%)                               |
| United Kingdom<br>(Northern Ireland) | 72                   | 11 (15.3%)                           | 0                   | –                                    |

### 3.2.4.2.4. Highly pathogenic avian influenza results by time

Figure 20 displays the timeline of HPAIV detections in wild birds in RCs in 2021, for passive and active surveillance separately (blue and red colours, respectively). As part of the continuing HPAI A (H5Nx) epidemic since late 2020, HPAIVs were detected from the first week of 2021. A second wave of HPAIV incursions was detected around week 40, with the highest proportion of HPAIV-positive wild birds in week 45. During this week, 27% of samples (passive and active surveillance combined) tested positive for HPAIVs. The highest proportion of HPAIV-positive wild birds during the first quarter was detected in week 9 (22%), which is in line with the increased sampling effort in the first quarter.

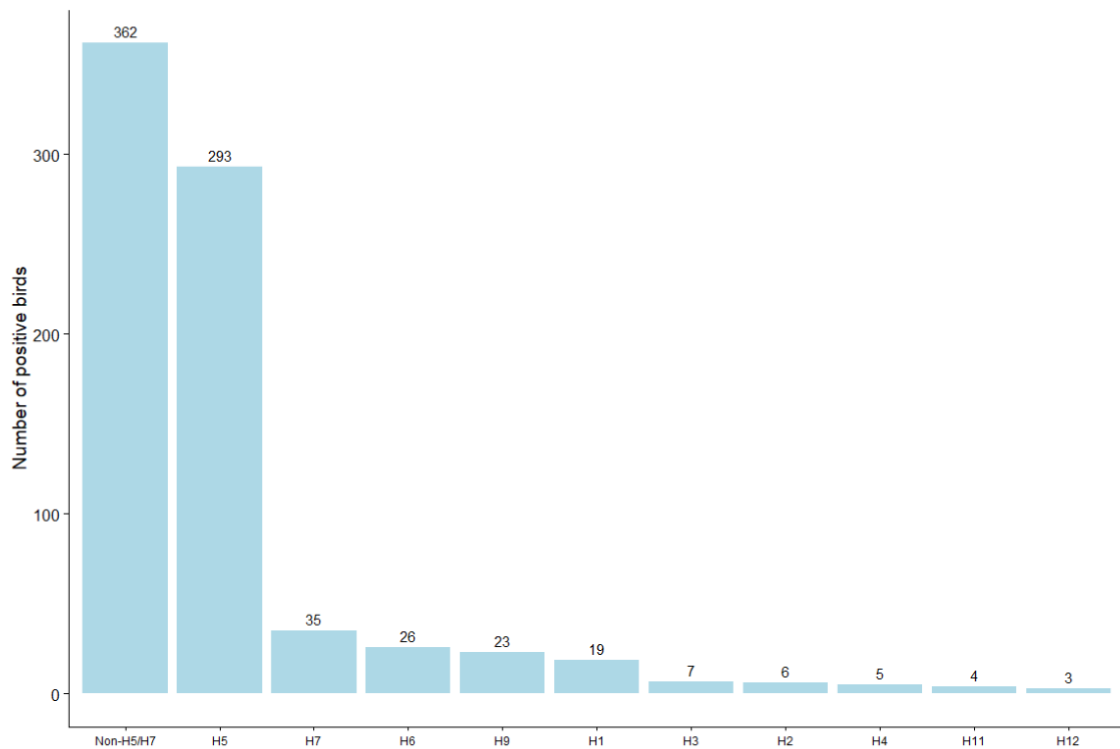


**Figure 20:** (A) Weekly number of wild birds sampled by both passive and active surveillance, (B) weekly percentage of HPAIV-positive wild birds found and (C) weekly number of HPAIV-positive wild birds by taxonomic order

### 3.2.5. Low pathogenic avian influenza in wild birds

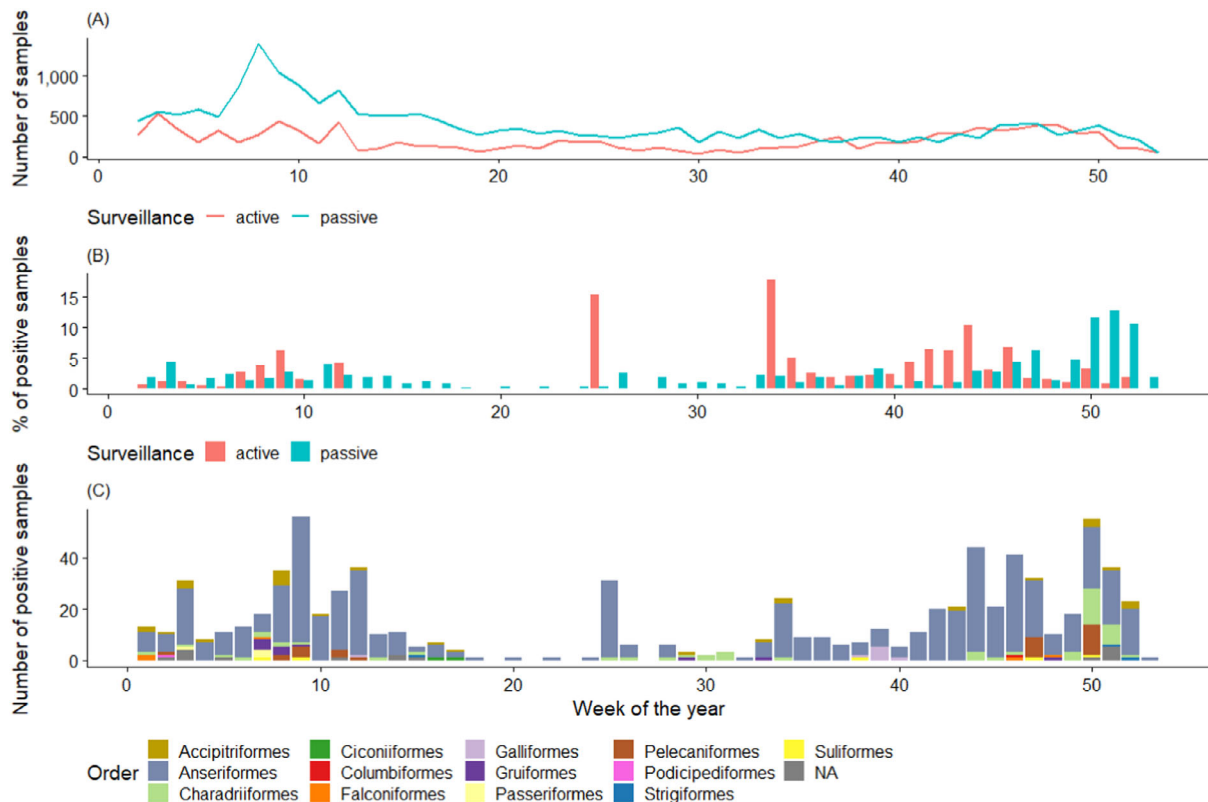
Among the 783 wild birds tested positive for AIVs other than HPAIVs, 107 wild birds were infected with LPAIVs, while no virus pathogenicity results were available for the remaining 676 wild birds. Out of the 676 wild birds for which information on the virus pathogenicity was not available, 247 wild birds were positive for influenza A(H5) and 3 for A(H7) viruses. For the remainder of this section, 'LPAIV-positive' wild birds include all positive wild birds which were not positive for HPAIVs (n = 783). This is consistent with previous reports.

LPAIV-positive wild birds were reported by 22 RCs. Among these positive wild birds, 293 were classified as influenza A(H5) and 35 as A(H7) viruses. The majority of the LPAIVs detected were reported as non-A(H5/H7) subtype AIVs (n = 362), without further information on the subtypes provided. Figure 21 summarises all the identified and reported LPAIVs.



**Figure 21:** AIV haemagglutinin (H) subtypes identified for LPAIV-positive wild birds. Values are provided above bars. Wild birds for which positive samples could not all be typed (for example, one sample was characterised as belonging to the A(H5) subtype, while for another sample from the same wild bird the H subtype was unknown) are classified under the H subtype that was available (in this example, the A(H5) subtype). There were no wild birds for which more than one H subtype was identified

As shown in Figure 22, most LPAIV-positive wild birds were found in week 50 ( $n = 39$ ) for both types of surveillance. However, as for HPAIV-positive wild birds, two distinct peaks of LPAIV detections can be identified: in the first and last quarters of the year. There were very few LPAIV-positive wild birds between March and August, except for week 25 for active surveillance. Most LPAIV-positive wild birds belonged to the order Anseriformes (Figure 22C), which is the most sampled order by both active and passive surveillance.



**Figure 22:** (A) Weekly number of wild birds sampled by both passive and active surveillance, (B) weekly percentage of LPAIV-positive wild birds found and (C) weekly number of LPAIV-positive wild birds by taxonomic order

### 3.3. Abundance and distribution of wild birds in Europe

Voluntary contribution data on abundance and distribution of wild bird species have been made available to EFSA by the EBP. EBP is one of the three major monitoring projects run by the European Bird Census Council (EBCC). This project mobilises year-round observational data submitted by volunteer birdwatchers to the online wild bird recording portals operating across Europe (ca. 50 million wild bird records from ca. 100,000 voluntary contributors annually). Information on the distribution of the 50 species included in the EFSA target list of wild bird species (Table E.1 in Appendix E) is now being submitted to EFSA annually, aggregated at NUTS3 and monthly level. The data provide two different measures for each NUTS3 region and month:

- the total number of all wild birds observed in that specific location during that month.
- the number of wild birds for each of the 50 species included in the target list of wild bird species observed in that location during that month.

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

Figure F.1 (Appendix F) shows the density of all wild birds (upper map) and wild birds of the 50 target species (lower map) observed in a specific location, each estimated as the total number of observations in the NUTS3 region divided by the surface of the area (also available in Zenodo (<https://doi.org/10.5281/zenodo.7053170>)). This figure shows that the highest densities of observations of wild birds (all species, i.e. an indirect measure of the observation effort) were in Belgium, Denmark, the Netherlands and some regions of Austria, France, Germany, Spain, Sweden, Switzerland and the United Kingdom. The density was lowest in Bulgaria, Croatia, Estonia, Greece, Hungary, Iceland, Ireland, Latvia, Romania and Slovenia. No data were available for Lithuania. Within countries, the variability between NUTS3 regions was high. During the course of the year, wild bird observations were reported at least once for 1,309 NUTS3 regions in total in the countries for which EBP data were



available. Wild birds from the EFSA target list were reported in all but 2 of these NUTS3 regions (Figure F.1, lower map).

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

Additional maps are available in Zenodo at the monthly level (<https://doi.org/10.5281/zenodo.7053222>): these maps display both the number of wild birds from target species observed in each NUTS3 region (EBP data) and the number of wild birds from target species sampled by passive surveillance (RCs data).

Figures F.2 and F.3 (Appendix F) show the distribution of wild bird observations according to the EBP data, by wild bird orders and species for the entire year, for the 50 species included in the EFSA target list (Table E.1 in Appendix E). A total of 46% of the observations reported concerned Anseriformes, followed by Pelecaniformes, Charadriiformes, Accipitriformes and Passeriformes. These distributions could not be compared to the distribution of orders and species sampled for AI surveillance, given that detailed data were only available for the target list species. For example, Columbiformes ranked third 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 found dead by passive surveillance programmes. There were 4,764 records of dead bird samples from EFSA target species for a given species, NUTS3 and month. Among these, 676 were not associated with a corresponding observation in the EBP data. Therefore, it is difficult to use the EBP data to assess the quality of passive surveillance in RCs.

## 4. Discussion and conclusions

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

A targeted (non-representative) sampling approach helps to increase the efficiency of detection of AIVs but prevents valid assessments of measures of disease, differences between locations, categories or species, or trends over time. Comparisons of seropositivity rates between different locations, categories, species or time periods are valid for the specific observations (surveillance samples) only and cannot be extrapolated to the source populations. Seropositivity rates are not only influenced by disease but also the efficiency of targeting of the risk-based sampling approach. Therefore, increases in seropositivity rates over time may be due to either changes in the disease situation or improved targeting. Changes in prevalence or incidence may not be fully captured by risk-based surveillance programmes only, which is why a more representative sampling approach should be followed, using methodologies that have been standardised between RCs, for interpretation and comparison of such numbers.

### 4.1. Poultry

An increasing trend in the number of PEs sampled was observed between 2017 and 2019 until a plateau of more than 24,000 PEs sampled per year was reached for the last 3 years. Both the number and proportion of PEs seropositive for influenza A(H5/H7) viruses were around half of the ones observed in 2020 with overall only 31 seropositive PEs identified in 2021. The cause of this decrease remains unclear. There may have been either changes in the disease situation or targeting approach. In addition to the small number of seropositive PEs, variations in sampling activities among RCs and between years mean that it was difficult to draw valid inferences from the percentages detected. In 2021, 27 PEs tested positive for influenza A(H5) and 4 for A(H7) viruses, while all HPAIV-positive detections in wild birds were characterised as HPAI A(H5) viruses. This confirms a more active circulation of influenza A(H5) compared to A(H7) viruses in Europe, consistent with previous years.

The 2 months with slightly higher A(H5/H7) seropositivity rates were May and December 2021, while the latter may have been linked to the large HPAI A(H5Nx) epidemic occurring in Europe since October 2020. This epidemic was associated with 3,700 outbreaks during the epidemic season of 2020–2021, in both poultry and wild birds (EFSA, ECDC and EURL, 2022), and is the largest HPAI A(H5Nx) epidemic recorded in the EU since the 2016–2017 epidemic (EFSA, ECDC and EURL, 2017a). Recent outbreaks in Europe in 2022 appear to be linked to an even wider epidemic

(EFSA, ECDC and EURL, 2022), which also includes Russia, Iraq and Kazakhstan (Lewis et al., 2021; Verhagen et al., 2021).

The serological test results by species in 2021 are consistent with findings from previous years. The highest risk of circulation of LPAIVs remains in aquatic birds (game birds, geese and ducks), while gallinaceous birds (in particular chickens and turkeys) were at low risk overall. While backyard establishments and conventional laying hens accounted for the largest numbers tested, only 3 and 1 seropositive PEs were identified, respectively. In Commission Delegated Regulation (EU) 2020/689, and as 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 LPAIVs. The poultry categories in which this surveillance is recommended include the poultry categories in which most of the positive serological test results have been found in recent years.

Active surveillance provides useful insights into the circulation of AIVs in PEs, in particular for LPAIVs and poultry species or categories which are mostly subclinically affected. However, the sensitivity of such surveillance approach remains limited, as it does not provide high coverage in terms of population and time. Therefore, the results obtained from different surveillance approaches should be considered when interpreting the present results.

According to Commission Decision 2010/367/EU<sup>10</sup>, MSs shall follow up on PEs with positive serological test results by performing PCR tests on the same flock and/or neighbouring flocks. Follow-up PCR test results were not available for 7 of the seropositive PEs at the time of writing this report. It is important to note that no investigation identifiers were available at the time of the 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 current data collection allows reporting of follow-up activities ('sampInfo\_origSampId'), and RCs are recommended to use this feature accordingly.

Finally, it is important to note that no data on the distribution and composition of the underlying poultry population were available to EFSA. Understanding the underlying population for the different poultry categories would improve interpretation of the AI surveillance results at European level.

## 4.2. Wild birds

The number of wild birds tested by passive surveillance in 2021 was substantially higher than in 2020 and 2019. Twenty-six out of 31 RCs sampled more wild birds by passive surveillance than in the previous year. Some countries also reported a large number of wild birds sampled under active surveillance activities (e.g. Belgium and Germany).

While 878 wild birds sampled tested positive for HPAIVs in 2020, a larger number of wild birds tested positive for HPAIVs in 2021. Out of the 2,314 HPAIV-positive wild birds, 2,220 were found dead, identified by passive surveillance programmes. These values continue to support the importance of this surveillance approach for AI surveillance in wild bird species. A large proportion of both sampling and HPAIV-positive test results occurred in the first and fourth quarters of 2021, confirming that the aforementioned epidemic of HPAI A(H5N8) in RCs in poultry is linked to a similar virus circulation in wild birds.

The respective proportions of wild birds sampled by passive surveillance and HPAIV-positive wild birds belonging to the list of target species recommended by EFSA remain relatively low (41% and 53% in 2020 and 2021, respectively). The present results suggest that the list could be adjusted with recent knowledge about the species of interest depending on their likelihood of dying when infected with HPAIVs.

Only half of all wild birds sampled were fully identified at species level. Effort should therefore be placed in developing and providing training for species identification.

Summary data provided by the EBP project are presented (Appendix F) to describe the number of wild bird observations reported by voluntary contributors in 2021. 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.

<sup>10</sup> 2010/367/: Commission Decision of 25 June 2010 on the implementation by Member States of surveillance programmes for avian influenza in poultry and wild birds (notified under document C(2010) 4190). OJ L 166, 1.7.2010, pp. 22–32.

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 voluntary 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), may help to shed light on areas where the wild birds of the species belonging to the target list may gather, supporting RCs in carrying out more targeted surveillance activities.

## 5. Methods

### 5.1. Framework for reporting

The development and implementation of active and passive surveillance programmes in poultry and wild birds in MSs is currently supported by Regulation (EU) 2016/429, which lays down the rules related to the EU surveillance programme for avian influenza, with Commission Delegated Regulation (EU) 2020/689 providing the technical requirements, such as objectives, scope and methodological principles, and Commission Decision 2010/367/EU providing more detailed guidelines for poultry and wild birds. Commission Implementing Regulation (EU) 2020/2002<sup>11</sup> lays down the procedures related to Union notification and Union reporting, while diagnostic procedures for testing the samples collected by the surveillance programmes are outlined in the Diagnostic Manual for avian influenza as set out in Decision 2006/437/EC<sup>12</sup>.

### 5.2. 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, 2021).

In some RCs, PEs were sampled several times throughout the year, which was the case for PEs containing one or different poultry categories. For the purpose of this report, each sampling exercise taking place on a specific date, in a specific PE and targeting a specific poultry category was considered as an independent event and counted as one PE sampled. As a result, an overestimation of the total number of PEs sampled may occur for some RCs, with this number being higher than the total number of PEs of a specific poultry category in a specific RC. Therefore, the numbers reported in this report as 'PEs sampled' should be interpreted as the numbers of sampling events taking place in a RC for each of the reported poultry categories. Throughout the report, the term 'number of PEs sampled' refers to all PEs sampled, regardless of the type of tests conducted on the samples (serology or virology).

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, 2019 and 2020 reports, the updated EFSA list of target species (Table E.1 in Appendix E) was used instead of the target list provided in 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 wild birds from which samples were pooled. When positive results were obtained from pooled samples (this occurred with pools of up to five wild birds), all the birds included in the pool were considered positive, given that no further information was available.<sup>13</sup>

Eurostat reference shapefiles were used to create the maps: 'Countries 2020' (version 3/6/2019) and 'NUTS 2016' (version 19/8/2019). These versions were used to match the units reported in the

<sup>11</sup> Commission Implementing Regulation (EU) 2020/2002 of 7 December 2020 laying down rules for the application of Regulation (EU) 2016/429 of the European Parliament and of the Council with regard to Union notification and Union reporting of listed diseases, to formats and procedures for submission and reporting of Union surveillance programmes and of eradication programmes and for application for recognition of disease-free status, and to the computerised information system. OJ L 412, 8.12.2020, pp. 1–28.

<sup>12</sup> 2006/437/EC: Commission Decision of 4 August 2006 approving a Diagnostic Manual for avian influenza as provided for in Council Directive 2005/94/EC (notified under document number C(2006) 3477). OJ L 237, 31.8.2006, pp. 1–27.

<sup>13</sup> This assumption very likely resulted in an over-estimation of the bird-level prevalence of LPAIVs. 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 may be used for statistical estimation of bird-level prevalence using a tool such as EpiTools (<https://epitools.ausvet.com.au/pooledprevalence>).

surveillance data for 2021. 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<sup>2</sup>, was displayed, given that the total number of PEs present in a given region was not available. Samples with location coordinates which could not be matched to a NUTS region from the country reporting the data are not displayed in the maps, but they are accounted for by all other figures and tables in the document.

The results presented in this report are based on the data reported to EFSA by RCs. As a result, data may differ, particularly with regard to HPAIV detections in wild birds, from data reported to the Animal Disease Information System (ADIS) or individual national surveillance databases.

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## Abbreviations

|       |  |
|-------|--|
| ADIS  | Animal Disease Information System                |
| AI    | Avian influenza                                  |
| AIV   | Avian influenza virus                            |
| EBCC  | European Bird Census Council                     |
| EBP   | EuroBird Portal                                  |
| H     | Haemagglutinin                                   |
| HPAI  | Highly pathogenic avian influenza                |
| HPAIV | Highly pathogenic avian influenza virus          |
| LPAI  | Low pathogenic avian influenza                   |
| LPAIV | Low pathogenic avian influenza virus             |
| MS    | Member State                                     |
| N     | Neuraminidase                                    |
| NUTS  | Nomenclature of Territorial Units for Statistics |
| PCR   | Polymerase chain reaction                        |

PE Poultry establishment  
RC Reporting country  
VI Virus isolation

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

**Table A.1:** Total number of PEs sampled and testing positive in 2021, according to the 17 poultry categories used in this report and the detailed reporting categories available to MSs

| Reporting category used in this report | Detailed reporting category      | Number of sampling events | Number of A(H5/H7)-positive events |
|--|----------------------------------|---------------------------|------------------------------------|
| Laying hens                            | Laying hens                      | 4,433                     | 45                                 |
| Free-range laying hens                 | Free-range laying hens           | 3,435                     | 55                                 |
| Breeding chickens                      | Breeding chickens                | 2,594                     | 51                                 |
| Broilers (heightened risk)             | Broilers                         | 1,093                     | 1                                  |
|  | Free-range broilers              | 219                       | 0                                  |
| Breeding turkeys                       | Breeding turkeys                 | 175                       | 7                                  |
| Fattening turkeys                      | Fattening turkeys                | 2,181                     | 8                                  |
|  | Free-range fattening turkeys     | 6                         | 1                                  |
| Breeding ducks                         | Breeding ducks                   | 206                       | 9                                  |
|  | Ducks                            | 6                         | 1                                  |
| Fattening ducks                        | Fattening ducks                  | 913                       | 27                                 |
|  | Free-range fattening ducks       | 27                        | 0                                  |
| Breeding geese                         | Breeding geese                   | 142                       | 6                                  |
| Fattening geese                        | Fattening geese                  | 326                       | 10                                 |
|  | Free-range fattening geese       | 37                        | 0                                  |
| Growers                                | Chickens                         | 33                        | 0                                  |
|  | Ducks                            | 9                         | 0                                  |
|  | Generic poultry                  | 2,217                     | 0                                  |
|  | Turkeys                          | 1                         | 0                                  |
| Backyard flocks                        | Backyard                         | 4,683                     | 54                                 |
| Muscovy ducks                          | Muscovy ducks                    | 4                         | 0                                  |
| Game birds (gallinaceous)              | Farmed game birds (Gallinaceous) | 315                       | 5                                  |
|  | Free-range pheasants             | 1                         | 0                                  |
|  | Guinea-fowl                      | 17                        | 0                                  |
|  | Partridges                       | 44                        | 2                                  |
|  | Pheasants                        | 120                       | 0                                  |
|  | Quails                           | 41                        | 0                                  |
| Game birds (waterfowl)                 | Farmed game birds (Waterfowl)    | 130                       | 34                                 |
|  | Mallard ducks                    | 9                         | 1                                  |
| Ratites                                | Free-range ostriches             | 17                        | 0                                  |
|  | Ostriches                        | 42                        | 0                                  |
|  | Ratites                          | 63                        | 2                                  |
| Others                                 | Chickens                         | 167                       | 19                                 |
|  | Ducks                            | 540                       | 3                                  |
|  | Geese                            | 11                        | 0                                  |
|  | Other                            | 22                        | 0                                  |
|  | Turkeys                          | 11                        | 0                                  |

**Table A.2:** Detailed mapping of the 17 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 method                    |
|--|------------------------------|--|-------------------------|--------------------------------------|
| Laying hens                            | Laying hens                  | <i>Gallus gallus</i> laying hens (as animal)     | Breeding purpose        | Not available                        |
|  |                              | <i>Gallus gallus</i> laying hens (as animal)     | Not available           | Not available                        |
| Free-range laying hens                 | Free-range laying hens       | <i>Gallus gallus</i> laying hens (as animal)     | Breeding purpose        | Outdoor/free-range growing condition |
|  |                              | <i>Gallus gallus</i> laying hens (as animal)     | Not available           | Outdoor/free-range growing condition |
| Breeding chickens                      | Breeding chickens            | <i>Gallus gallus</i> breeding flock (as animals) | Breeding purpose        | Not available                        |
|  |                              | <i>Gallus gallus</i> breeding flock (as animals) | Not available           | Not available                        |
|  | Free-range breeding chickens | <i>Gallus gallus</i> breeding flock (as animals) | Not available           | Outdoor/free-range growing condition |
| Broilers (heightened risk)             | Broilers                     | <i>Gallus gallus</i> broiler (as animal)         | Breeding purpose        | Not available                        |
|  |                              | <i>Gallus gallus</i> broiler (as animal)         | Meat production purpose | Not available                        |
|  |                              | <i>Gallus gallus</i> broiler (as animal)         | Not available           | Not available                        |
|  | Free-range broilers          | <i>Gallus gallus</i> broiler (as animal)         | Not available           | Outdoor/free-range growing condition |
| Breeding turkeys                       | Breeding turkeys             | Turkey breeding flock (as animals)               | Breeding purpose        | Not available                        |
|  |                              | Turkey breeding flock (as animals)               | Not available           | Not available                        |
| Fattening turkeys                      | Fattening turkeys            | Turkey fattening animal (as animal)              | Breeding purpose        | Not available                        |
|  |                              | 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 |
| 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                        |
|  |                              | Duck laying hens (as animal)                     | Breeding purpose        | Not available                        |
| Fattening ducks                        | Fattening ducks              | Duck fattening animal (as animal)                | Breeding purpose        | Not available                        |
|  |                              | Duck fattening animal (as animal)                | Game purpose            | Not available                        |

| Reporting category used in this report | Detailed reporting category | Poultry species                                  | Purpose of raising      | Production method                    |
|--|-----------------------------|--|-------------------------|--------------------------------------|
|  |                             | 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 |
| 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 |
|  | Geese                       | Goose laying hens (as animal)                    | Breeding purpose        | Not available                        |
| 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 |
| Growers                                | Chickens                    | <i>Gallus gallus</i> (chicken) (as animal)       | Growers                 | Not available                        |
|  | Ducks                       | Duck (as animal)                                 | Growers                 | Not available                        |
|  | Generic poultry             | Generic poultry (as animal)                      | Growers                 | Not available                        |
|  | Turkeys                     | Turkey (as animal)                               | Growers                 | Not available                        |
| Backyard flocks                        | Backyard                    | Anseriformes (as animal)                         | Not available           | Backyard farming – growing           |
|  |                             | Duck (as animal)                                 | Breeding purpose        | Backyard farming – growing           |
|  |                             | Duck (as animal)                                 | Growers                 | Backyard farming – growing           |
|  |                             | Duck (as animal)                                 | Meat production purpose | Backyard farming – growing           |
|  |                             | Duck (as animal)                                 | Not available           | Backyard farming – growing           |
|  |                             | Duck breeding flock (as animals)                 | Not available           | Backyard farming – growing           |
|  |                             | Duck fattening animal (as animal)                | Not available           | Backyard farming – growing           |
|  |                             | <i>Gallus gallus</i> (chicken) (as animal)       | Growers                 | Backyard farming – growing           |
|  |                             | <i>Gallus gallus</i> (chicken) (as animal)       | Not available           | Backyard farming – growing           |
|  |                             | <i>Gallus gallus</i> breeding flock (as animals) | Breeding purpose        | Backyard farming – growing           |
|  |                             | <i>Gallus gallus</i> breeding flock (as animals) | Not available           | Backyard farming – growing           |
|  |                             | <i>Gallus gallus</i> broiler (as animal)         | Meat production purpose | Backyard farming – growing           |

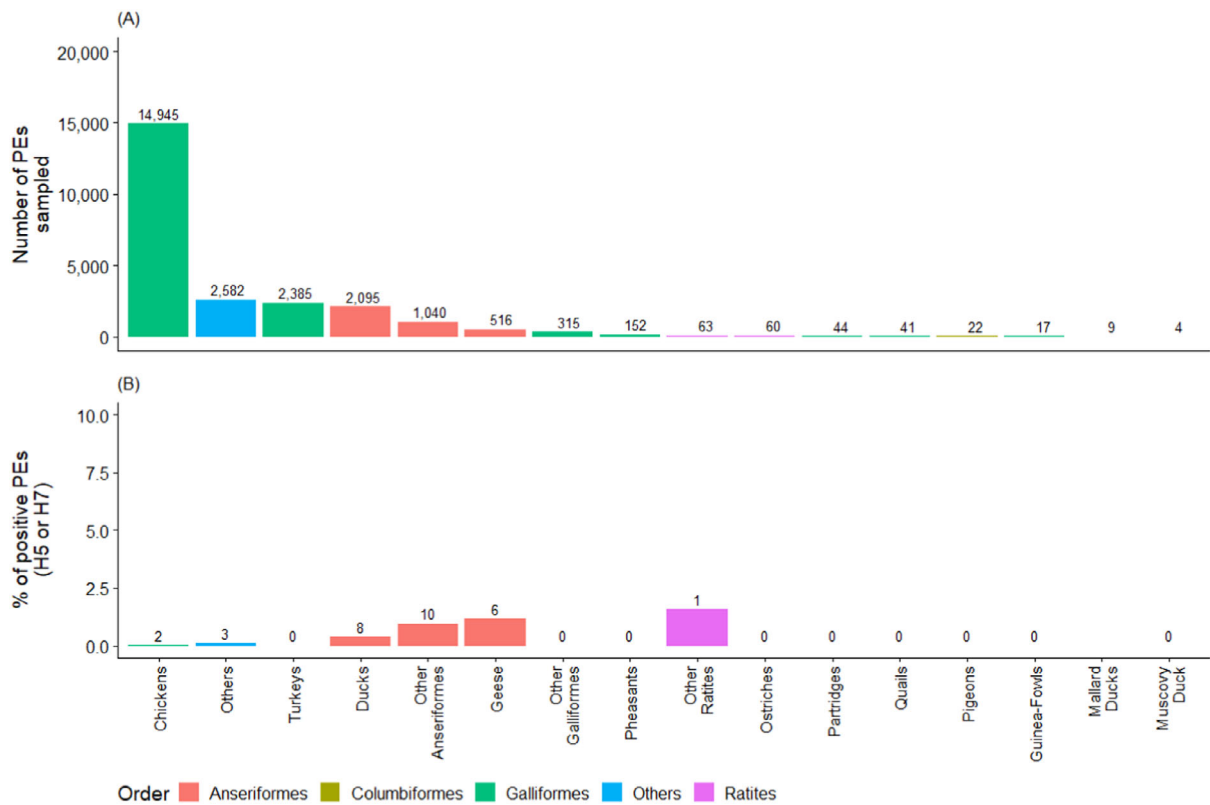


| Reporting category used in this report | Detailed reporting category      | Poultry species                              | Purpose of raising      | Production method                    |
|--|----------------------------------|--|-------------------------|--------------------------------------|
|  |                                  | <i>Gallus gallus</i> broiler (as animal)     | Not available           | Backyard farming – growing           |
|  |                                  | <i>Gallus gallus</i> laying hens (as animal) | Breeding purpose        | Backyard farming – growing           |
|  |                                  | <i>Gallus gallus</i> laying hens (as animal) | Not available           | Backyard farming – growing           |
|  |                                  | Generic poultry (as animal)                  | Growers                 | Backyard farming – growing           |
|  |                                  | Generic poultry (as animal)                  | Not available           | Backyard farming – growing           |
|  |                                  | Goose (as animal)                            | Not available           | Backyard farming – growing           |
|  |                                  | Goose breeding flock (as animals)            | Not available           | Backyard farming – growing           |
|  |                                  | Goose fattening animal (as animal)           | Not available           | Backyard farming – growing           |
|  |                                  | Guinea-fowl (as animal)                      | Not available           | Backyard farming – growing           |
|  |                                  | Ostrich (as animal)                          | Not available           | Backyard farming – growing           |
|  |                                  | Pheasant (as animal)                         | Breeding purpose        | Backyard farming – growing           |
|  |                                  | Pheasant (as animal)                         | Game purpose            | Backyard farming – growing           |
|  |                                  | Pheasant (as animal)                         | Not available           | Backyard farming – growing           |
|  |                                  | Turkey (as animal)                           | Not available           | Backyard farming – growing           |
|  |                                  | Turkey breeding flock (as animals)           | Not available           | Backyard farming – growing           |
|  |                                  | Turkey fattening animal (as animal)          | Meat production purpose | Backyard farming – growing           |
|  |                                  | Turkey fattening animal (as animal)          | Not available           | Backyard farming – growing           |
| Muscovy ducks                          | Muscovy ducks                    | Muscovy duck (as animal)                     | Not available           | Not available                        |
| 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                        |
|  | Other                            | Game or wild bird (as animal)                | Game purpose            | Not available                        |
|  | Partridges                       | Partridge (as animal)                        | Breeding purpose        | Not available                        |
| Partridge (as animal)                  |                                  | Game purpose                                 | Not available           |                                      |

| Reporting category used in this report | Detailed reporting category   | Poultry species                        | Purpose of raising                   | Production method                    |
|--|-------------------------------|--|--------------------------------------|--------------------------------------|
| Game birds (waterfowl)                 |                               | 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                        |
|  |                               | Partridge fattening animal (as animal) | Not available                        | Not available                        |
|  | Pheasants                     | Pheasant (as animal)                   | Breeding purpose                     | Not available                        |
|  |                               | 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                        |
|  |                               | Grey partridge (as animal)             | Not available                        | Not available                        |
|  |                               | Quail (as animal)                      | Breeding purpose                     | 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                        |
|  | Ducks                         | Duck (as animal)                       | Game purpose                         | Not available                        |
|  | Farmed game birds (waterfowl) | <i>Anas</i> sp.(as animal)             | Not available                        | Not available                        |
|  |                               | Anseriformes (as animal)               | Game purpose                         | Not available                        |
|  |                               | Anseriformes (as animal)               | Not available                        | Not available                        |
| Anseriformes (as animal)               |                               | Not available                          | Outdoor/free-range growing condition |                                      |
| Common goldeneye (as animal)           |                               | Not available                          | Not available                        |                                      |
| Velvet scoter (as animal)              |                               | Not available                          | Not available                        |                                      |
| Wood duck (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                        |                                      |

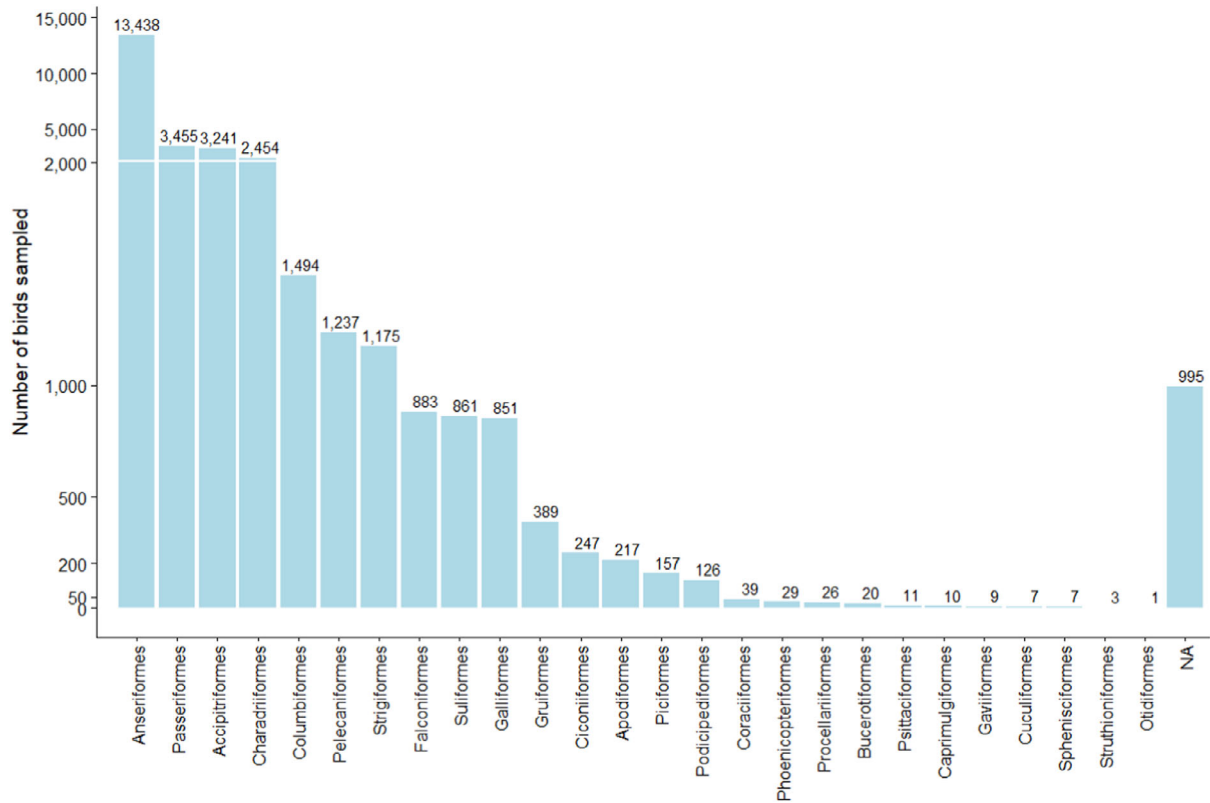
| Reporting category used in this report | Detailed reporting category | Poultry species                            | Purpose of raising      | Production method                    |
|--|-----------------------------|--|-------------------------|--------------------------------------|
| Ratites                                | 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           |                                      |
| Others                                 | Chickens                    | <i>Gallus gallus</i> (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         | <i>Gallus gallus</i> (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                       | Cattle egret (as animal)                   | Not available           | Not available                        |
|  |                             | Common cuckoo (as animal)                  | Not available           | Not available                        |
|  |                             | Eurasian spoonbill (as animal)             | Not available           | Not available                        |
|  |                             | Falco (as animal)                          | Not available           | Not available                        |
|  |                             | Greater flamingo (as animal)               | Not available           | Not available                        |
|  |                             | Pigeon (as animal)                         | Not available           | Backyard farming – growing           |
|  |                             | Pigeon (as animal)                         | Not available           | Not available                        |
|  |                             | Saker falcon (as animal)                   | Not available           | Not available                        |
|  | Parrots                     | Parrots (as animal)                        | Not available           | Not available                        |
|  |                             | Psittaciformes (as animal)                 | Not available           | Backyard farming – growing           |
|  |                             | Psittaciformes (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                        |

## Appendix B – Serological test results by poultry species



**Figure B.1:** (A) Number of PEs sampled by poultry species, (B) proportion of PEs sampled that tested positive for influenza A(H5/H7) viruses by serology. The numbers above bars indicate the numbers of seropositive PEs. Bars are colour-coded to identify the order to which species belong to. Species names were not reported for some PEs, for which only the wild bird order was identified. Ostriches, emus and other ratites were classified under the term 'ratites' (no order), given that species names were not always available

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



**Figure C.1:** Total numbers of wild birds of the different orders sampled by passive and active surveillance by RCs in 2021. The group 'NA' includes all wild birds for which data on species and order were not available. The y-axis is presented on a non-linear scale to improve visibility

## Appendix D – Scientific and common names of wild bird species

**Table D.1:** English common names and scientific names of wild bird species sampled in 2021

| Scientific name                  | English common name         |
|----------------------------------|-----------------------------|
| <i>Acanthis flammea</i>          | Redpoll                     |
| <i>Accipiter gentilis</i>        | Northern goshawk            |
| <i>Accipiter nisus</i>           | Eurasian sparrowhawk        |
| <i>Acrocephalus arundinaceus</i> | Great reed-warbler          |
| <i>Actitis hypoleucos</i>        | Common sandpiper            |
| <i>Aegithalos caudatus</i>       | Long-tailed tit             |
| <i>Aegolius funereus</i>         | Boreal owl                  |
| <i>Aegypius monachus</i>         | Cinereous vulture           |
| <i>Aix galericulata</i>          | Mandarin duck               |
| <i>Aix sponsa</i>                | Wood duck                   |
| <i>Alauda arvensis</i>           | Eurasian skylark            |
| <i>Alca torda</i>                | Razorbill                   |
| <i>Alcedo atthis</i>             | Common kingfisher           |
| <i>Alectoris chukar</i>          | Chukar                      |
| <i>Alectoris graeca</i>          | Rock partridge              |
| <i>Alectoris rufa</i>            | Red-legged partridge        |
| <i>Alle alle</i>                 | Little auk                  |
| <i>Alopochen aegyptiaca</i>      | Egyptian goose              |
| <i>Amazona leucocephala</i>      | Cuban parrot                |
| <i>Amazona oratrix</i>           | Yellow-headed amazon        |
| <i>Anas acuta</i>                | Northern pintail            |
| <i>Anas crecca</i>               | Common teal                 |
| <i>Anas platyrhynchos</i>        | Mallard                     |
| <i>Anser albifrons</i>           | Greater white-fronted goose |
| <i>Anser anser</i>               | Greylag goose               |
| <i>Anser brachyrhynchus</i>      | Pink-footed goose           |
| <i>Anser cygnoides</i>           | Swan goose                  |
| <i>Anser erythropus</i>          | Lesser white-fronted goose  |
| <i>Anser fabalis</i>             | Bean goose                  |
| <i>Anthus pratensis</i>          | Meadow pipit                |
| <i>Anthus trivialis</i>          | Tree pipit                  |
| <i>Apus apus</i>                 | Common swift                |
| <i>Apus pallidus</i>             | Pallid swift                |
| <i>Aquila adalberti</i>          | Spanish imperial eagle      |
| <i>Aquila chrysaetos</i>         | Golden eagle                |
| <i>Aquila fasciata</i>           | Bonelli's eagle             |
| <i>Aquila heliaca</i>            | Eastern imperial eagle      |
| <i>Ardea alba</i>                | Great white egret           |
| <i>Ardea cinerea</i>             | Grey heron                  |
| <i>Ardea purpurea</i>            | Purple heron                |
| <i>Arenaria interpres</i>        | Ruddy turnstone             |
| <i>Asio flammeus</i>             | Short-eared owl             |
| <i>Asio otus</i>                 | Northern long-eared owl     |
| <i>Athene noctua</i>             | Little owl                  |
| <i>Aythya ferina</i>             | Common pochard              |
| <i>Aythya fuligula</i>           | Tufted duck                 |
| <i>Aythya marila</i>             | Greater scaup               |

| Scientific name                      | English common name    |
|--------------------------------------|------------------------|
| <i>Aythya nyroca</i>                 | Ferruginous duck       |
| <i>Bombycilla garrulus</i>           | Bohemian waxwing       |
| <i>Bonasa bonasia</i>                | Hazel grouse           |
| <i>Botaurus lentiginosus</i>         | American bittern       |
| <i>Botaurus stellaris</i>            | Eurasian bittern       |
| <i>Branta bernicla</i>               | Brent goose            |
| <i>Branta canadensis</i>             | Canada goose           |
| <i>Branta leucopsis</i>              | Barnacle goose         |
| <i>Branta ruficollis</i>             | Red-breasted goose     |
| <i>Bubo bubo</i>                     | Eurasian eagle-owl     |
| <i>Bubo scandiacus</i>               | Snowy owl              |
| <i>Bubulcus ibis</i>                 | Cattle egret           |
| <i>Bucephala clangula</i>            | Common goldeneye       |
| <i>Burhinus oedicephalus</i>         | Eurasian thick-knee    |
| <i>Buteo buteo</i>                   | Eurasian buzzard       |
| <i>Buteo lagopus</i>                 | Rough-legged buzzard   |
| <i>Buteo rufinus</i>                 | Long-legged buzzard    |
| <i>Butorides striata</i>             | Green-backed heron     |
| <i>Cairina moschata</i>              | Muscovy duck           |
| <i>Calidris alba</i>                 | Sanderling             |
| <i>Calidris alpina</i>               | Dunlin                 |
| <i>Calidris canutus</i>              | Red knot               |
| <i>Calidris ferruginea</i>           | Curlew sandpiper       |
| <i>Calidris minuta</i>               | Little stint           |
| <i>Calidris pugnax</i>               | Ruff                   |
| <i>Calonectris diomedea</i>          | Scopoli's shearwater   |
| <i>Caprimulgus europaeus</i>         | European nightjar      |
| <i>Carduelis carduelis</i>           | European goldfinch     |
| <i>Cephus grylle</i>                 | Black guillemot        |
| <i>Charadrius alexandrinus</i>       | Kentish plover         |
| <i>Charadrius dubius</i>             | Little ringed plover   |
| <i>Charadrius hiaticula</i>          | Common ringed plover   |
| <i>Chlidonias niger</i>              | Black tern             |
| <i>Chloris chloris</i>               | European greenfinch    |
| <i>Ciconia ciconia</i>               | White stork            |
| <i>Ciconia nigra</i>                 | Black stork            |
| <i>Circaetus gallicus</i>            | Short-toed snake-eagle |
| <i>Circus aeruginosus</i>            | Western marsh-harrier  |
| <i>Circus cyaneus</i>                | Hen harrier            |
| <i>Circus pygargus</i>               | Montagu's harrier      |
| <i>Cisticola juncidis</i>            | Zitting cisticola      |
| <i>Clanga pomarina</i>               | Lesser spotted eagle   |
| <i>Clangula hyemalis</i>             | Long-tailed duck       |
| <i>Coccothraustes coccothraustes</i> | Hawfinch               |
| <i>Columba livia</i>                 | Rock dove              |
| <i>Columba oenas</i>                 | Stock dove             |
| <i>Columba palumbus</i>              | Common woodpigeon      |
| <i>Copsychus malabaricus</i>         | White-rumped shama     |
| <i>Coracias garrulus</i>             | European roller        |
| <i>Corvus corax</i>                  | Common raven           |

| Scientific name                 | English common name         |
|---------------------------------|-----------------------------|
| <i>Corvus corone</i>            | Carrion crow                |
| <i>Corvus frugilegus</i>        | Rook                        |
| <i>Corvus monedula</i>          | Eurasian jackdaw            |
| <i>Coturnix coturnix</i>        | Common quail                |
| <i>Crex crex</i>                | Corncrake                   |
| <i>Cuculus canorus</i>          | Common cuckoo               |
| <i>Cyanecula svecica</i>        | Bluethroat                  |
| <i>Cyanistes caeruleus</i>      | Eurasian blue tit           |
| <i>Cyanocorax yncas</i>         | Inca jay                    |
| <i>Cyanopica cooki</i>          | Iberian azure-winged magpie |
| <i>Cygnus atratus</i>           | Black swan                  |
| <i>Cygnus columbianus</i>       | Tundra swan                 |
| <i>Cygnus cygnus</i>            | Whooper swan                |
| <i>Cygnus olor</i>              | Mute swan                   |
| <i>Delichon urbicum</i>         | Northern house martin       |
| <i>Dendrocopos leucotos</i>     | White-backed woodpecker     |
| <i>Dendrocopos major</i>        | Great spotted woodpecker    |
| <i>Dryobates minor</i>          | Lesser spotted woodpecker   |
| <i>Dryocopus martius</i>        | Black woodpecker            |
| <i>Egretta garzetta</i>         | Little egret                |
| <i>Elanus caeruleus</i>         | Black-winged kite           |
| <i>Emberiza cirius</i>          | Cirl bunting                |
| <i>Emberiza citrinella</i>      | Yellowhammer                |
| <i>Erithacus rubecula</i>       | European robin              |
| <i>Eudocimus ruber</i>          | Scarlet ibis                |
| <i>Eudromias morinellus</i>     | Eurasian fotherrel          |
| <i>Falco columbarius</i>        | Merlin                      |
| <i>Falco eleonora</i>           | Eleonora's falcon           |
| <i>Falco naumanni</i>           | Lesser kestrel              |
| <i>Falco peregrinus</i>         | Peregrine falcon            |
| <i>Falco rusticolus</i>         | Gyr Falcon                  |
| <i>Falco subbuteo</i>           | Eurasian hobby              |
| <i>Falco tinnunculus</i>        | Common kestrel              |
| <i>Ficedula hypoleuca</i>       | European pied flycatcher    |
| <i>Francolinus francolinus</i>  | Black francolin             |
| <i>Fratercula arctica</i>       | Atlantic puffin             |
| <i>Fringilla coelebs</i>        | Common chaffinch            |
| <i>Fringilla montifringilla</i> | Brambling                   |
| <i>Fulica atra</i>              | Common coot                 |
| <i>Fulica cristata</i>          | Red-knobbed coot            |
| <i>Fulmarus glacialis</i>       | Northern fulmar             |
| <i>Gallinago gallinago</i>      | Common snipe                |
| <i>Gallinula chloropus</i>      | Common moorhen              |
| <i>Gallus gallus</i>            | Chicken                     |
| <i>Garrulus glandarius</i>      | Eurasian jay                |
| <i>Gavia arctica</i>            | Arctic loon                 |
| <i>Gavia stellata</i>           | Red-throated loon           |
| <i>Geronticus eremita</i>       | Northern bald ibis          |
| <i>Glaucidium passerinum</i>    | Eurasian pygmy-owl          |
| <i>Grus grus</i>                | Common crane                |



| Scientific name                    | English common name        |
|------------------------------------|----------------------------|
| <i>Grus virgo</i>                  | Demoiselle crane           |
| <i>Guira guira</i>                 | Guira cuckoo               |
| <i>Gypaetus barbatus</i>           | Bearded vulture            |
| <i>Gyps fulvus</i>                 | Griffon vulture            |
| <i>Gyps himalayensis</i>           | Himalayan vulture          |
| <i>Gyps rueppelli</i>              | Rüppell's vulture          |
| <i>Haematopus ostralegus</i>       | Eurasian oystercatcher     |
| <i>Haliaeetus albicilla</i>        | White-tailed sea-eagle     |
| <i>Hieraaetus pennatus</i>         | Booted eagle               |
| <i>Himantopus himantopus</i>       | Black-winged stilt         |
| <i>Hirundo rustica</i>             | Barn swallow               |
| <i>Hydrobates pelagicus</i>        | European storm-petrel      |
| <i>Hydrocoloeus minutus</i>        | Little gull                |
| <i>Ixobrychus minutus</i>          | Common little bittern      |
| <i>Lagopus lagopus</i>             | Willow grouse              |
| <i>Lanius collurio</i>             | Red-backed shrike          |
| <i>Lanius excubitor</i>            | Great grey shrike          |
| <i>Lanius minor</i>                | Lesser grey shrike         |
| <i>Larus argentatus</i>            | European herring gull      |
| <i>Larus cachinnans</i>            | Caspian gull               |
| <i>Larus canus</i>                 | Mew gull                   |
| <i>Larus fuscus</i>                | Lesser black-backed gull   |
| <i>Larus marinus</i>               | Great black-backed gull    |
| <i>Larus melanocephalus</i>        | Mediterranean gull         |
| <i>Larus michahellis</i>           | Yellow-legged gull         |
| <i>Larus ridibundus</i>            | Black-headed gull          |
| <i>Leiopicus medius</i>            | Middle spotted woodpecker  |
| <i>Limosa lapponica</i>            | Bar-tailed godwit          |
| <i>Locustella naevia</i>           | Common grasshopper-warbler |
| <i>Lophura leucomelanos</i>        | Kalij pheasant             |
| <i>Loxia curvirostra</i>           | Red crossbill              |
| <i>Lyrurus tetrix</i>              | Black grouse               |
| <i>Mareca penelope</i>             | Eurasian wigeon            |
| <i>Mareca strepera</i>             | Gadwall                    |
| <i>Marmaronetta angustirostris</i> | Marbled teal               |
| <i>Melanitta fusca</i>             | Velvet scoter              |
| <i>Melanitta nigra</i>             | Common scoter              |
| <i>Melanocorypha calandra</i>      | Calandra lark              |
| <i>Mergellus albellus</i>          | Smew                       |
| <i>Mergus merganser</i>            | Goosander                  |
| <i>Mergus serrator</i>             | Red-breasted merganser     |
| <i>Merops apiaster</i>             | European bee-eater         |
| <i>Microcarbo niger</i>            | Little cormorant           |
| <i>Microcarbo pygmaeus</i>         | Pygmy cormorant            |
| <i>Milvus migrans</i>              | Black kite                 |
| <i>Milvus milvus</i>               | Red kite                   |
| <i>Morus bassanus</i>              | Northern gannet            |
| <i>Morus capensis</i>              | Cape gannet                |
| <i>Motacilla alba</i>              | White wagtail              |
| <i>Muscicapa striata</i>           | Spotted flycatcher         |

| Scientific name                  | English common name       |
|----------------------------------|---------------------------|
| <i>Myiopsitta monachus</i>       | Monk parakeet             |
| <i>Neophron percnopterus</i>     | Egyptian vulture          |
| <i>Netta rufina</i>              | Red-crested pochard       |
| <i>Nucifraga caryocatactes</i>   | Northern nutcracker       |
| <i>Numenius arquata</i>          | Eurasian curlew           |
| <i>Numenius phaeopus</i>         | Whimbrel                  |
| <i>Nycticorax nycticorax</i>     | Black-crowned night-heron |
| <i>Oenanthe oenanthe</i>         | Northern wheatear         |
| <i>Oriolus oriolus</i>           | Eurasian golden oriole    |
| <i>Otis tarda</i>                | Great bustard             |
| <i>Otus scops</i>                | Eurasian scops-owl        |
| <i>Oxyura leucocephala</i>       | White-headed duck         |
| <i>Pandion haliaetus</i>         | Osprey                    |
| <i>Parus major</i>               | Great tit                 |
| <i>Passer domesticus</i>         | House sparrow             |
| <i>Passer montanus</i>           | Eurasian tree sparrow     |
| <i>Pavo cristatus</i>            | Peafowl                   |
| <i>Pelecanus crispus</i>         | Dalmatian pelican         |
| <i>Pelecanus onocrotalus</i>     | Great white pelican       |
| <i>Perdicinae</i>                | Partridge                 |
| <i>Perdix perdix</i>             | Grey partridge            |
| <i>Pernis apivorus</i>           | European honey-buzzard    |
| <i>Pernis ptilorhynchus</i>      | Oriental honey-buzzard    |
| <i>Phalacrocorax aristotelis</i> | European shag             |
| <i>Phalacrocorax carbo</i>       | Great cormorant           |
| <i>Phasianus colchicus</i>       | Common pheasant           |
| <i>Phasianus versicolor</i>      | Green pheasant            |
| <i>Phoenicopterus roseus</i>     | Greater flamingo          |
| <i>Phoenicopterus ruber</i>      | American flamingo         |
| <i>Phoenicurus ochruros</i>      | Black redstart            |
| <i>Phoenicurus phoenicurus</i>   | Common redstart           |
| <i>Phylloscopus collybita</i>    | Common chiffchaff         |
| <i>Phylloscopus sibilatrix</i>   | Wood warbler              |
| <i>Pica pica</i>                 | Eurasian magpie           |
| <i>Picus canus</i>               | Grey-faced woodpecker     |
| <i>Picus viridis</i>             | Eurasian green woodpecker |
| <i>Platalea leucorodia</i>       | Eurasian spoonbill        |
| <i>Plegadis falcinellus</i>      | Glossy ibis               |
| <i>Podiceps cristatus</i>        | Great crested grebe       |
| <i>Podiceps nigricollis</i>      | Black-necked grebe        |
| <i>Porphyrio porphyrio</i>       | Purple swamphen           |
| <i>Porzana porzana</i>           | Spotted crane             |
| <i>Prunella modularis</i>        | Dunnock                   |
| <i>Psittacula krameri</i>        | Rose-ringed parakeet      |
| <i>Psittacus erithacus</i>       | Grey parrot               |
| <i>Ptyonoprogne rupestris</i>    | Eurasian crag martin      |
| <i>Puffinus puffinus</i>         | Manx shearwater           |
| <i>Puffinus yelkouan</i>         | Yelkouan shearwater       |
| <i>Pyrrhonorax pyrrhonorax</i>   | Red-billed chough         |
| <i>Pyrrhula pyrrhula</i>         | Eurasian bullfinch        |

| Scientific name                 | English common name    |
|---------------------------------|------------------------|
| <i>Rallus aquaticus</i>         | Western water rail     |
| <i>Recurvirostra avosetta</i>   | Pied avocet            |
| <i>Regulus ignicapilla</i>      | Common firecrest       |
| <i>Regulus regulus</i>          | Goldcrest              |
| <i>Rissa tridactyla</i>         | Black-legged kittiwake |
| <i>Saxicola torquatus</i>       | Common stonechat       |
| <i>Scolopax rusticola</i>       | Eurasian woodcock      |
| <i>Serinus serinus</i>          | European serin         |
| <i>Sitta europaea</i>           | Eurasian nuthatch      |
| <i>Somateria mollissima</i>     | Common eider           |
| <i>Spatula clypeata</i>         | Northern shoveler      |
| <i>Spatula querquedula</i>      | Garganey               |
| <i>Spinus spinus</i>            | Eurasian siskin        |
| <i>Sterna hirundo</i>           | Common tern            |
| <i>Sterna paradisaea</i>        | Arctic tern            |
| <i>Streptopelia decaocto</i>    | Eurasian collared-dove |
| <i>Streptopelia turtur</i>      | European turtle-dove   |
| <i>Strix aluco</i>              | Tawny owl              |
| <i>Strix nebulosa</i>           | Great grey owl         |
| <i>Strix uralensis</i>          | Ural owl               |
| <i>Struthio camelus</i>         | Ostrich                |
| <i>Sturnus unicolor</i>         | Spotless starling      |
| <i>Sturnus vulgaris</i>         | Common starling        |
| <i>Surnia ulula</i>             | Northern hawk-owl      |
| <i>Sylvia atricapilla</i>       | Eurasian blackcap      |
| <i>Sylvia borin</i>             | Garden warbler         |
| <i>Sylvia communis</i>          | Common whitethroat     |
| <i>Sylvia curruca</i>           | Lesser whitethroat     |
| <i>Sylvia melanocephala</i>     | Sardinian warbler      |
| <i>Tachybaptus ruficollis</i>   | Little grebe           |
| <i>Tachymarpis melba</i>        | Alpine swift           |
| <i>Tadorna ferruginea</i>       | Ruddy shelduck         |
| <i>Tadorna tadorna</i>          | Common shelduck        |
| <i>Tetrao urogallus</i>         | Western capercaillie   |
| <i>Threskiornis aethiopicus</i> | African sacred ibis    |
| <i>Tringa glareola</i>          | Wood sandpiper         |
| <i>Tringa totanus</i>           | Common redshank        |
| <i>Troglodytes troglodytes</i>  | Northern wren          |
| <i>Turdus iliacus</i>           | Redwing                |
| <i>Turdus merula</i>            | Eurasian blackbird     |
| <i>Turdus philomelos</i>        | Song thrush            |
| <i>Turdus pilaris</i>           | Fieldfare              |
| <i>Turdus viscivorus</i>        | Mistle thrush          |
| <i>Tyto alba</i>                | Common barn-owl        |
| <i>Upupa epops</i>              | Common hoopoe          |
| <i>Uria aalge</i>               | Common guillemot       |
| <i>Vanellus vanellus</i>        | Northern lapwing       |

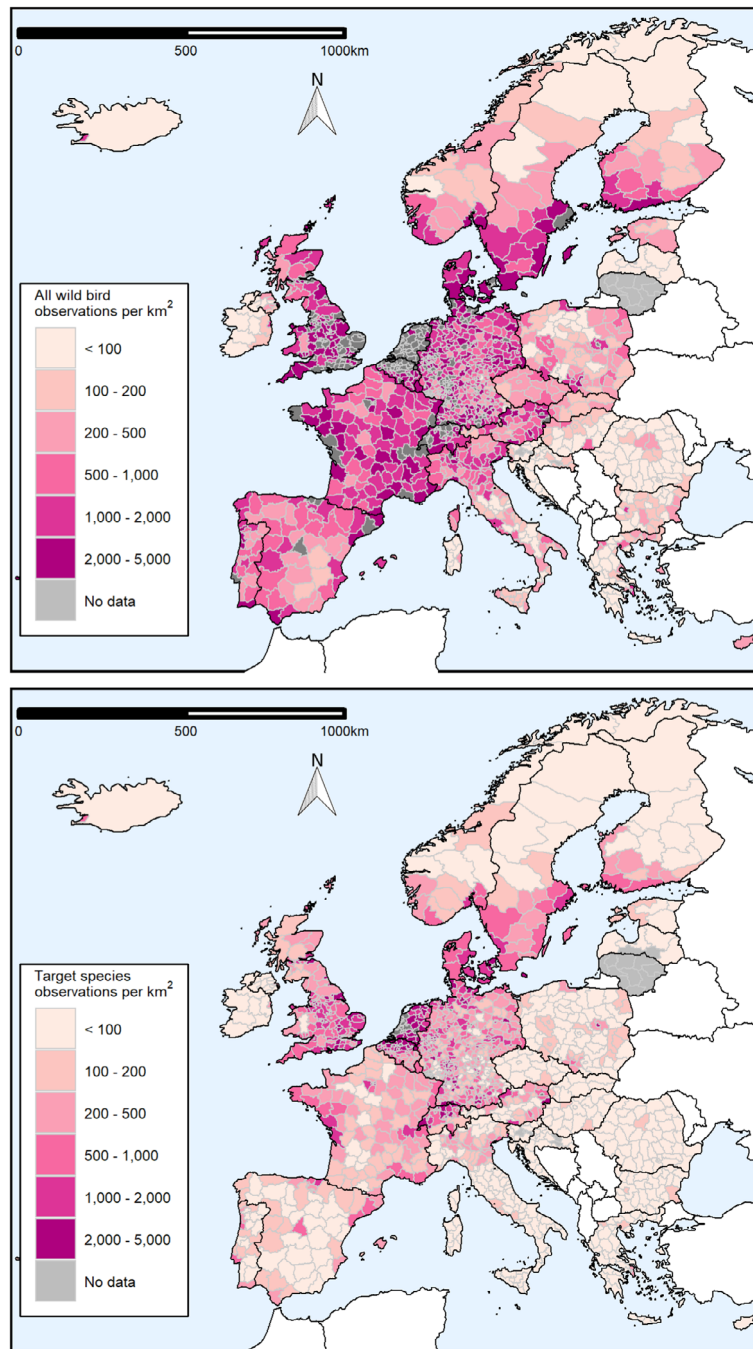
## Appendix E – EFSA list of target wild bird species for avian influenza surveillance

**Table E.1:** List of target wild bird species published in December 2017 (EFSA, ECDC and EURL, 2017b) (species not sampled in 2021 are highlighted in grey)

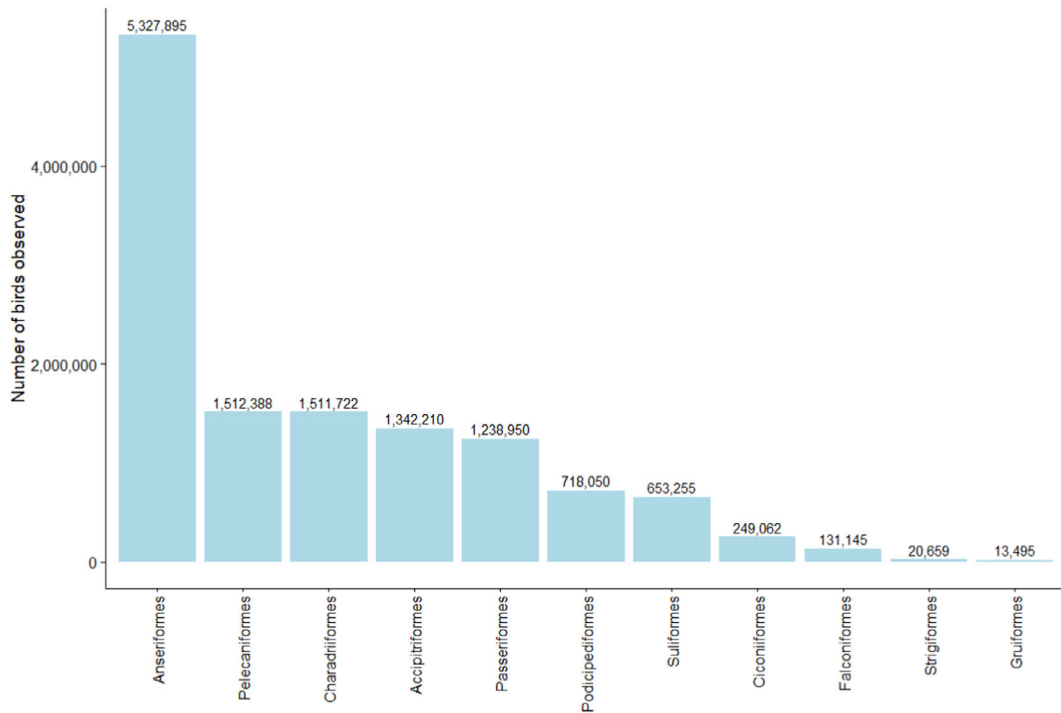
| Family   | Subfamily, tribe or genus  | Species  |
|--|--|--|
| Coots, crakes and rails (Rallidae)                                 |  | Western swamphen ( <i>Porphyrio porphyrio</i> )    |
| Cormorants and shags (Phalacrocoracidae)                           |  | Great cormorant ( <i>Phalacrocorax carbo</i> )     |
| Corvids (Corvidae)   |  | Eurasian magpie ( <i>Pica pica</i> )               |
| Ducks, geese and swans (Anatidae)                                  | Dabbling ducks (Anatinae)  | Eurasian teal ( <i>Anas crecca</i> )               |
|  | Dabbling ducks (Anatinae)  | Eurasian wigeon ( <i>Anas penelope</i> )           |
|  | Dabbling ducks (Anatinae)  | Gadwall ( <i>Anas strepera</i> )                   |
|  | Dabbling ducks (Anatinae)  | Mallard ( <i>Anas platyrhynchos</i> )              |
|  | Dabbling ducks (Anatinae)  | Northern pintail ( <i>Anas acuta</i> )             |
|  | Diving ducks (Aythyini)  | Common pochard ( <i>Aythya ferina</i> )            |
|  | Diving ducks (Aythyini)  | Greater scaup ( <i>Aythya marila</i> )             |
|  | Diving ducks (Aythyini)  | Red-crested pochard ( <i>Netta rufina</i> )        |
|  | Diving ducks (Aythyini)  | Tufted duck ( <i>Aythya fuligula</i> )             |
|  | Sea ducks (Mergini)  | Common eider ( <i>Somateria mollissima</i> )       |
|  | Sea ducks (Mergini)  | Common goldeneye ( <i>Bucephala clangula</i> )     |
|  | Sea ducks (Mergini)  | Goosander ( <i>Mergus merganser</i> )              |
|  | Sea ducks (Mergini)  | Smew ( <i>Mergus albellus</i> )                    |
|  | Shelducks and sheldgeese (Tadorninae)                              | Common shelduck ( <i>Tadorna tadorna</i> )         |
|  | Shelducks and sheldgeese (Tadorninae)                              | Egyptian goose ( <i>Alopochen aegyptiacus</i> )    |
|  | Swans ( <i>Cygnus</i> sp.)   | Black swan ( <i>Cygnus atratus</i> )               |
|  | Swans ( <i>Cygnus</i> sp.)   | Mute swan ( <i>Cygnus olor</i> )                   |
|  | Swans ( <i>Cygnus</i> sp.)   | Whooper swan ( <i>Cygnus cygnus</i> )              |
|  | True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Brant goose ( <i>Branta bernicla</i> )             |
|  | True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Canada goose ( <i>Branta canadensis</i> )          |
| True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Greater white-fronted goose ( <i>Anser albifrons</i> )             |  |
| True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Greylag goose ( <i>Anser anser</i> )                               |  |
| True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Lesser white-fronted goose ( <i>Anser erythropus</i> )             |  |
| True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Pink-footed goose ( <i>Anser brachyrhynchus</i> )                  |  |
| True geese ( <i>Anser</i> sp., <i>Branta</i> sp., <i>Chen</i> sp.) | Taiga bean Goose ( <i>Anser fabalis</i> )                          |  |
| Grebes (Podicipedidae)   |  | Black-necked grebe ( <i>Podiceps nigricollis</i> ) |
|  |  | Great crested grebe ( <i>Podiceps cristatus</i> )  |
|  |  | Little grebe ( <i>Tachybaptus ruficollis</i> )     |

| Family  | Subfamily, tribe or genus | Species   |
|---|---------------------------|---|
| Gulls, terns and allies (Laridae)             |                           | Black-headed gull ( <i>Chroicocephalus ridibundus</i> ) |
|   |                           | European herring gull ( <i>Larus argentatus</i> )       |
|   |                           | Great black-backed gull ( <i>Larus marinus</i> )        |
|   |                           | Mew gull ( <i>Larus canus</i> )                         |
| Herons (Ardeidae)                             |                           | Eurasian bittern ( <i>Botaurus stellaris</i> )          |
|   |                           | Great white egret ( <i>Egretta alba</i> )               |
|   |                           | Grey heron ( <i>Ardea cinerea</i> )                     |
|   |                           | Little egret ( <i>Egretta garzetta</i> )                |
| Pelicans (Pelecanidae)                        |                           | Dalmatian pelican ( <i>Pelecanus crispus</i> )          |
|   |                           | Great white pelican ( <i>Pelecanus onocrotalus</i> )    |
| Raptors (Accipitridae, Falconidae, Strigidae) |                           | Common buzzard ( <i>Buteo buteo</i> )                   |
|   |                           | Eurasian eagle-owl ( <i>Bubo bubo</i> )                 |
|   |                           | Northern goshawk ( <i>Accipiter gentilis</i> )          |
|   |                           | Peregrine falcon ( <i>Falco peregrinus</i> )            |
|   |                           | Rough-legged buzzard ( <i>Buteo lagopus</i> )           |
|   |                           | White-tailed eagle ( <i>Haliaeetus albicilla</i> )      |
| Sandpipers (Scolopacidae)                     |                           | Green sandpiper ( <i>Tringa ochropus</i> )              |
| Storks (Ciconiidae)                           |                           | White stork ( <i>Ciconia ciconia</i> )                  |
| Thrushes (Turdidae)                           |                           | Fieldfare ( <i>Turdus pilaris</i> )                     |

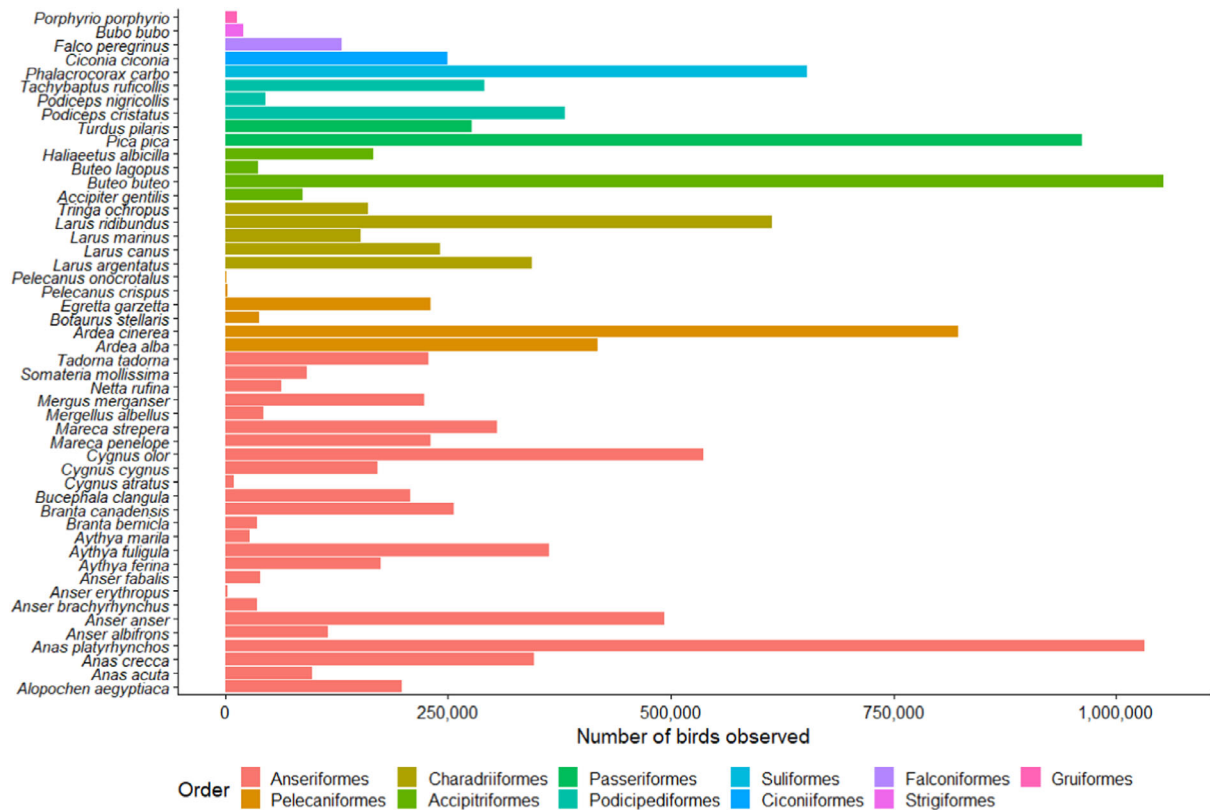
## Appendix F – Wild bird observations by voluntary contributors



**Figure F.1:** Density of wild bird observations for 2021 by NUTS3 region, as per data provided by the EBP 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 wild bird species, while the lower map is restricted to species from the EFSA target list

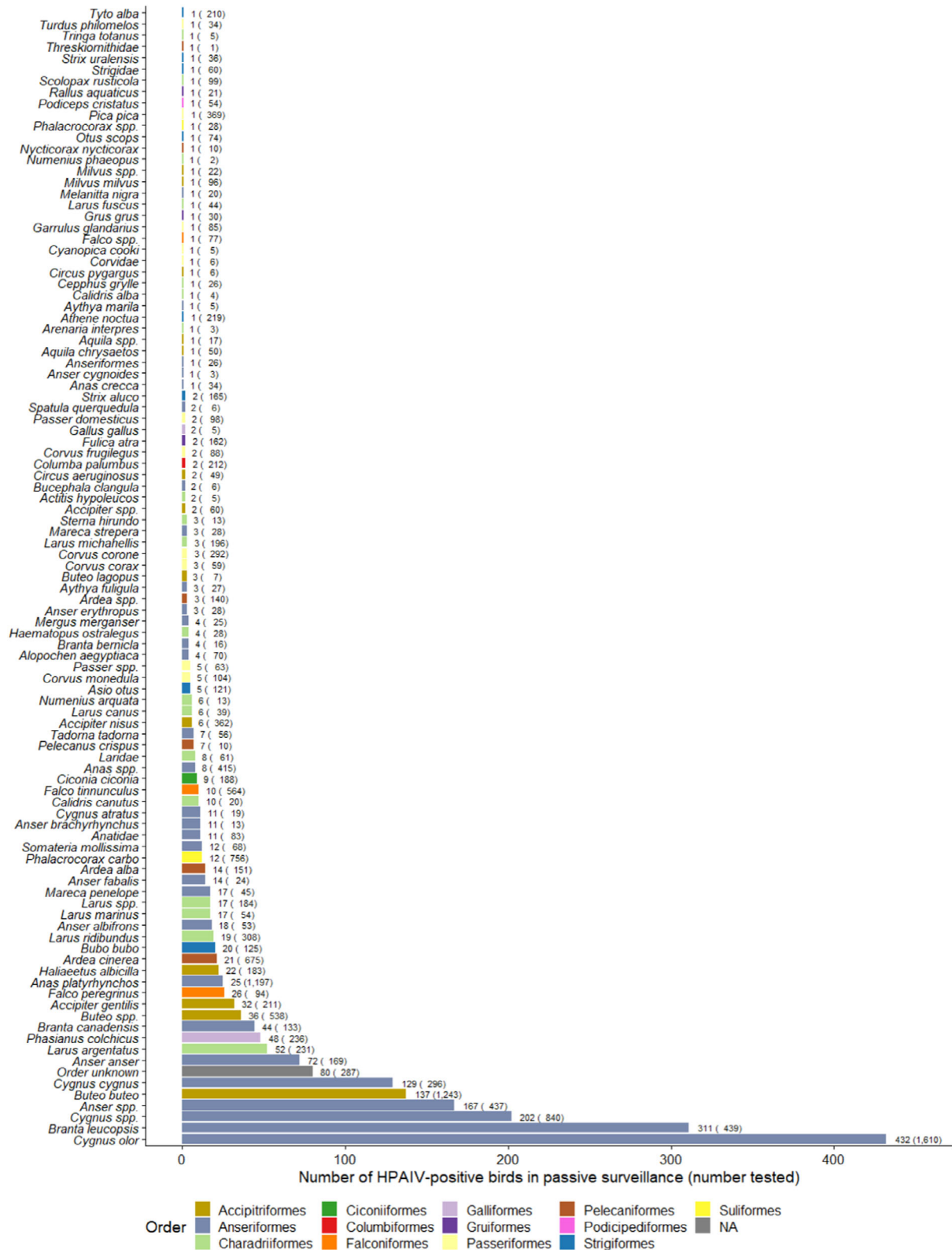


**Figure F.2:** Number of wild birds from the EFSA list of target wild bird species (n = 50) observed in 2021 and recorded in the EBP project, aggregated by wild bird order



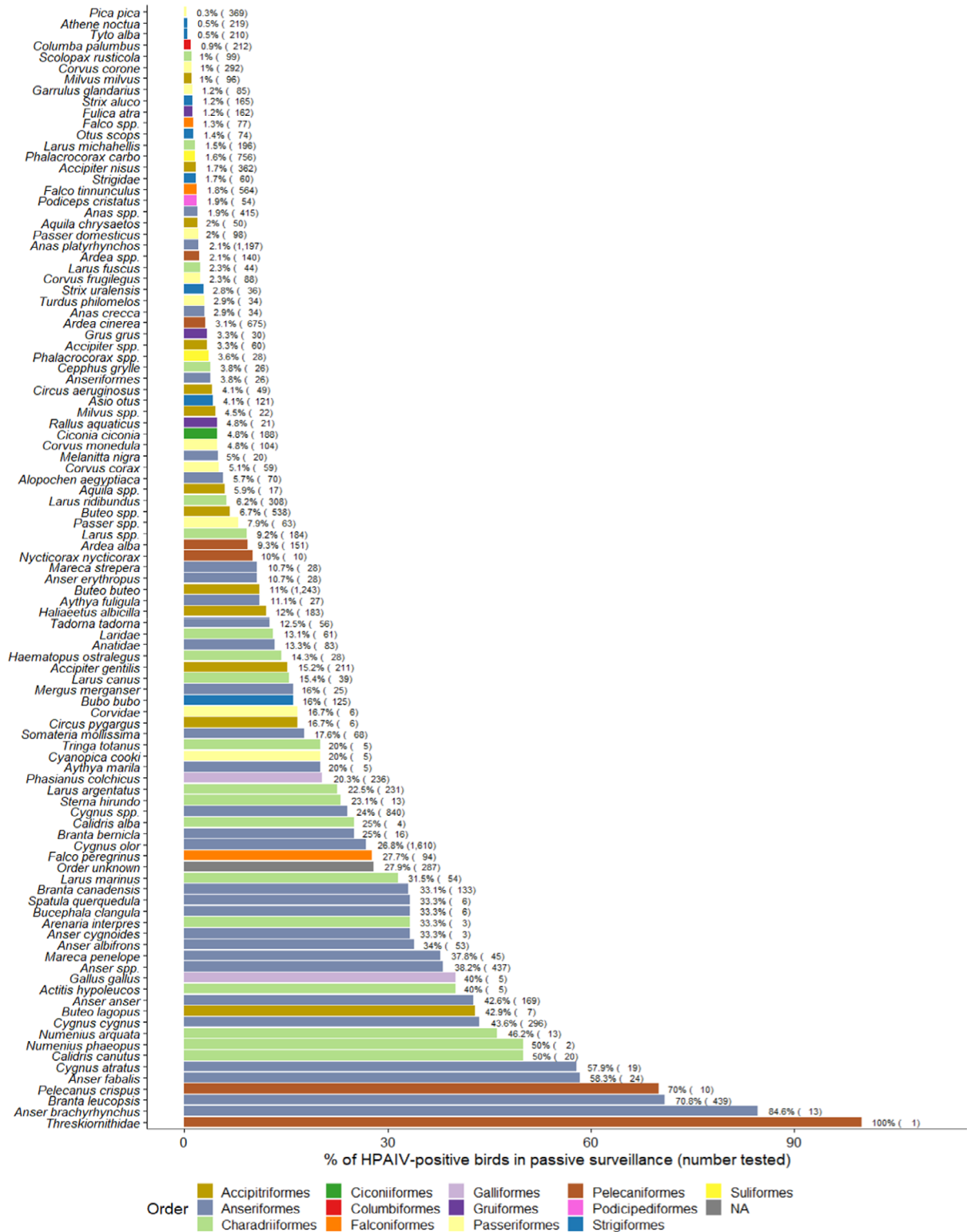
**Figure F.3:** Number of wild birds from the EFSA list of target wild bird species (n = 50) observed in 2021 and recorded in the EBP project, aggregated by wild bird species

## Appendix G – Wild bird species detected positive for highly pathogenic avian influenza viruses by passive surveillance



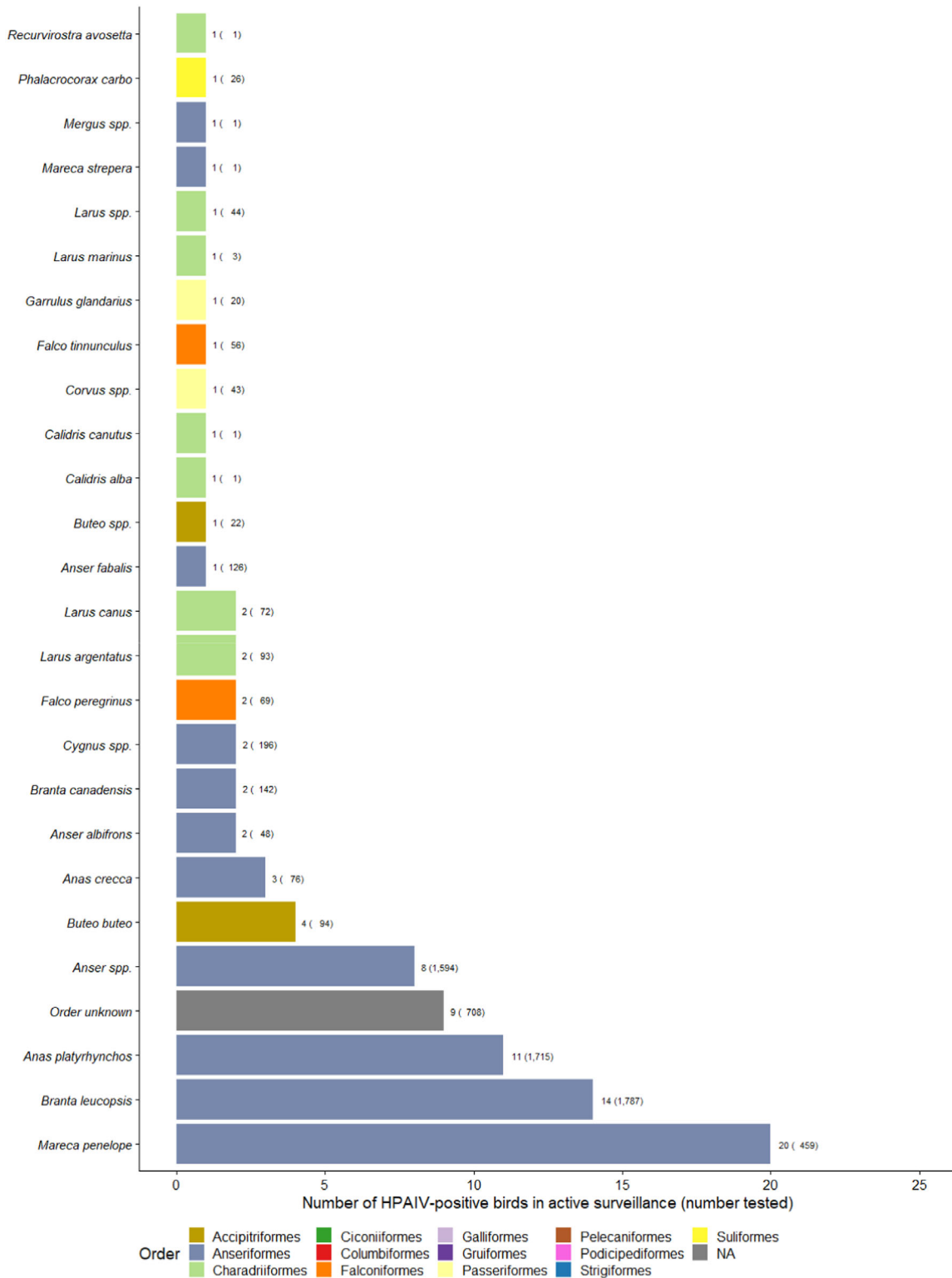
**Figure G.1:** Number of HPAIV-positive wild birds detected by passive surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing number of positive wild birds and colour-coded to identify the order to which species belong to



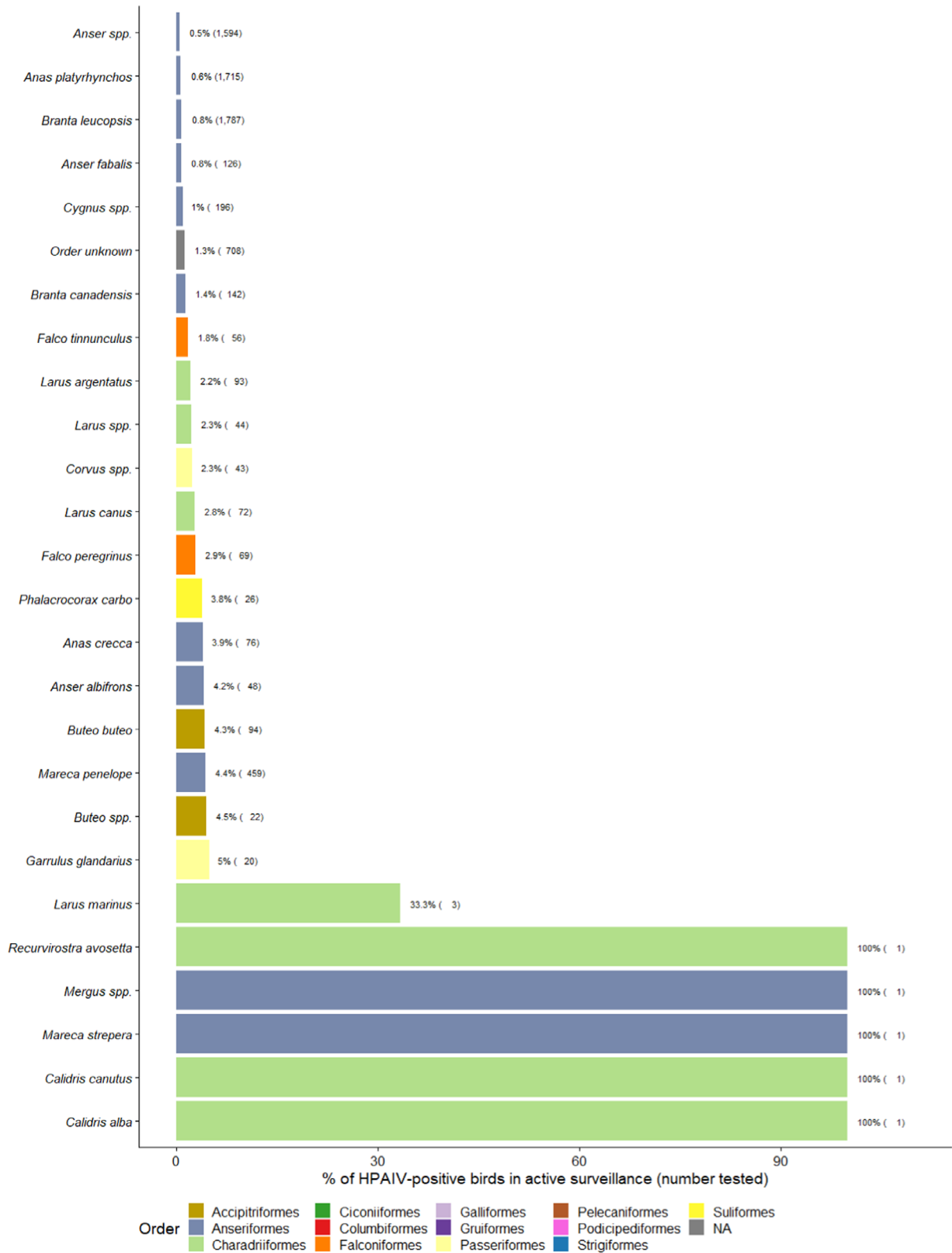


**Figure G.2:** Proportion of HPAIV-positive wild birds detected among wild birds tested by passive surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing proportion of positive wild birds and colour-coded to identify the order to which species belong to

### Appendix H – Wild bird species detected positive for highly pathogenic avian influenza viruses by active surveillance



**Figure H.1:** Number of HPAIV-positive wild birds detected by active surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing number of positive wild birds and colour-coded to identify the order to which species belong to



**Figure H.2:** Proportion of HPAIV-positive wild birds detected among wild birds tested by active surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing proportion of positive wild birds and colour-coded to identify the order to which species belong to

## Appendix I – Country data sets

**Table I.1:** Links to the AI data sets for 2021 by RC. All country data sets containing the tables on the occurrence of AI per country are available on the EFSA Knowledge Junction community on Zenodo. The countries that submitted data sets on the 2021 surveillance data this year are: the 27 EU MSs, United Kingdom (Northern Ireland) and 3 non-EU MSs

| Country           | Link to the data set  |
|-------------------|---|
| <b>EU MSs</b>     |   |
| AT                | <a href="https://doi.org/10.5281/zenodo.6794634">https://doi.org/10.5281/zenodo.6794634</a> |
| BE                | <a href="https://doi.org/10.5281/zenodo.6794740">https://doi.org/10.5281/zenodo.6794740</a> |
| BG                | <a href="https://doi.org/10.5281/zenodo.6794811">https://doi.org/10.5281/zenodo.6794811</a> |
| CY                | <a href="https://doi.org/10.5281/zenodo.6794832">https://doi.org/10.5281/zenodo.6794832</a> |
| CZ                | <a href="https://doi.org/10.5281/zenodo.6796827">https://doi.org/10.5281/zenodo.6796827</a> |
| DE                | <a href="https://doi.org/10.5281/zenodo.6796855">https://doi.org/10.5281/zenodo.6796855</a> |
| DK                | <a href="https://doi.org/10.5281/zenodo.6796876">https://doi.org/10.5281/zenodo.6796876</a> |
| EE                | <a href="https://doi.org/10.5281/zenodo.6796892">https://doi.org/10.5281/zenodo.6796892</a> |
| EL                | <a href="https://doi.org/10.5281/zenodo.6796910">https://doi.org/10.5281/zenodo.6796910</a> |
| ES                | <a href="https://doi.org/10.5281/zenodo.6796946">https://doi.org/10.5281/zenodo.6796946</a> |
| FI                | <a href="https://doi.org/10.5281/zenodo.6796988">https://doi.org/10.5281/zenodo.6796988</a> |
| FR                | <a href="https://doi.org/10.5281/zenodo.6797019">https://doi.org/10.5281/zenodo.6797019</a> |
| HR                | <a href="https://doi.org/10.5281/zenodo.6797057">https://doi.org/10.5281/zenodo.6797057</a> |
| HU                | <a href="https://doi.org/10.5281/zenodo.6798653">https://doi.org/10.5281/zenodo.6798653</a> |
| IE                | <a href="https://doi.org/10.5281/zenodo.6798657">https://doi.org/10.5281/zenodo.6798657</a> |
| IT                | <a href="https://doi.org/10.5281/zenodo.6798665">https://doi.org/10.5281/zenodo.6798665</a> |
| LV                | <a href="https://doi.org/10.5281/zenodo.6798667">https://doi.org/10.5281/zenodo.6798667</a> |
| LU                | <a href="https://doi.org/10.5281/zenodo.6798679">https://doi.org/10.5281/zenodo.6798679</a> |
| LT                | <a href="https://doi.org/10.5281/zenodo.6798692">https://doi.org/10.5281/zenodo.6798692</a> |
| MT                | <a href="https://doi.org/10.5281/zenodo.6793344">https://doi.org/10.5281/zenodo.6793344</a> |
| NL                | <a href="https://doi.org/10.5281/zenodo.6798704">https://doi.org/10.5281/zenodo.6798704</a> |
| PL                | <a href="https://doi.org/10.5281/zenodo.6798709">https://doi.org/10.5281/zenodo.6798709</a> |
| PT                | <a href="https://doi.org/10.5281/zenodo.6798719">https://doi.org/10.5281/zenodo.6798719</a> |
| RO                | <a href="https://doi.org/10.5281/zenodo.6798739">https://doi.org/10.5281/zenodo.6798739</a> |
| SI                | <a href="https://doi.org/10.5281/zenodo.6798748">https://doi.org/10.5281/zenodo.6798748</a> |
| SE                | <a href="https://doi.org/10.5281/zenodo.6798767">https://doi.org/10.5281/zenodo.6798767</a> |
| SK                | <a href="https://doi.org/10.5281/zenodo.6798775">https://doi.org/10.5281/zenodo.6798775</a> |
| XI                | <a href="https://doi.org/10.5281/zenodo.6798804">https://doi.org/10.5281/zenodo.6798804</a> |
| <b>Non-EU MSs</b> |   |
| CH                | <a href="https://doi.org/10.5281/zenodo.6793371">https://doi.org/10.5281/zenodo.6793371</a> |
| IS                | <a href="https://doi.org/10.5281/zenodo.6798885">https://doi.org/10.5281/zenodo.6798885</a> |
| NO                | <a href="https://doi.org/10.5281/zenodo.6798906">https://doi.org/10.5281/zenodo.6798906</a> |