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# Annual report on surveillance for avian influenza in poultry and wild birds in Member States of the European Union in 2022

**European Food Safety Authority (EFSA) | Inma Aznar | Lisa Kohnle | Anca Stoicescu | Aniek van Houtum | Gabriele Zancanaro**

**Correspondence:** biohaw@efsa.europa.eu

**Abstract**

All European Union (EU) Member States (MSs) are required to implement surveillance for avian influenza (AI) in poultry and wild birds and (i) to notify the outbreaks, when relevant and (ii) to report the results to the responsible authority. In addition, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) also implement ongoing surveillance programmes to monitor occurrences 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, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) in 2022. Overall, the 31 reporting countries (RCs) sampled 22,171 **poultry establishments (PEs)** during the 2022 surveillance activity: 18,490 PEs were sampled for serological testing and 3775 were sampled for virological testing. Some PEs were therefore sampled for both type of analytical methods. Out of the 18,490 PEs sampled for serological testing, 15 (0.08%) were seropositive for influenza A(H5) viruses. Out of the 3775 PEs sampled for virological testing, 74 PEs (1.96%) were positive to the virological assay for influenza A(H5) viruses. Seropositive PEs were found in four RCs (Belgium, Poland, Spain and Sweden) and as in previous years, the highest percentages of seropositive PEs were found in PEs raising breeding geese and waterfowl game birds. Out of these 15 seropositive PEs, 3 also tested positive by polymerase chain reaction (PCR) for influenza A (H5) viruses – 2 for highly pathogenic avian influenza virus (HPAIV) and 1 low pathogenic avian influenza (LPAI) (H5N3). In relation to the virological surveys, 10 RCs (32%) out of the 31 reported the detection of A (H5) viruses in 74 PEs, covering 12 different poultry categories. More specifically, 54 reported HPAIV A(H5N1), 17 HPAIV (H5N8), 2 AIV (H5N1) with unknown virus pathogenicity and 1 low pathogenic avian influenza (LPAI) (H5N3). Additionally, six PEs tested positive for undefined AIVs in three RCs. A total of 32,143 **wild birds** were sampled, with 4163 (12.95%) wild birds testing positive for HPAIVs by PCR, from 25 RCs. In contrast to previous years, out of the 4163 wild birds testing positive for HPAIv, subtype A(H5N1) virus was the main influenza A virus subtype identified among the wild bird testing positive for HPAIVs (3942; 95%). In addition, RCs also reported 984 wild birds testing positive for low pathogenic avian influenza (LPAI). Out of those, for 660 (67%) it was ascertained that the subtype was non-A(H5/H7); 260 (26%) wild birds tested positive for LPAIv of A(H5 or H7) subtypes and the remaining 64 (7%) LPAI viruses were belonging to other H-subtypes.

**KEYWORDS**

2022, avian influenza, HPAI, LPAI, poultry, surveillance, wild birds

# CONTENTS

# 1 | SUMMARY

The European Union (EU) Member States (MSs), Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) (a total of 31 countries together referred to as Reporting Countries, RCs) implement surveillance programmes to detect occurrences 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 2022, which consisted of:

- virological surveys to monitor the circulation of highly pathogenic influenza viruses (HPAIVs) of A(H5) and A(H7) subtypes in PEs holding poultry species (ducks, geese, poultry belonging to the species of *Anseriformes* for supplies of game or quails to be released into the wild) that do generally not display significant signs when infected with HPAI. These surveys can be supplemented by serological surveys if appropriate. This is a risk-based surveillance activity.
- serological surveys to monitor the circulation of low pathogenic avian influenza virus (LPAIVs) of A(H5) and A(H7) subtypes in high-risk PEs (infected with LPAIV and with continuous spread of LPAIV) which can be replaced by virological surveys if is justified (e.g. when for technical reasons or other duly justified reasons sampling for serology is not appropriate). This is a risk-based surveillance activity.
- Early detection of AIVs in wild birds found dead, found injured or sick, or hunted with clinical signs by virological surveys.

In addition, in line with Commission Delegated Regulation (EU) 2020/689, some MSs reported results from PCR tests conducted in PEs as part of the surveillance activities which did not relate to follow-up testing (e.g. screening) and results of tests performed on live healthy wild birds and hunted healthy wild birds. Risk-based sampling strategies used for AI surveillance may vary between countries. Therefore, the positivity rates for different groups, such as different poultry categories, presented in this report are not necessarily based on representative methods 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 with unknown relative risk values.

Starting from 2024, the RCs will be given the opportunity to submit data on poultry population. With this information EFSA may be in the position to provide a better interpretation of the submitted laboratory data. Nonetheless, the targeting approach may be different between countries, between groups and between years. Risk-based surveillance is designed for early detection and should not be used to measure changes in disease prevalence or incidence.

The differences in AIV incidence between countries observed in this report, both in poultry and wild birds, should be interpreted with caution. Direct comparisons between countries must be avoided.

## 1.1 | Serological and virological 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 purposes 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. Sixteen poultry categories (Table A.2 in Appendix A) have been used to summarise the surveillance results in the present report.

Figures on the size of the poultry population (e.g. the overall number of PEs) under surveillance in RCs were not available at the time of writing, nor data on the number of animals in sampled farms. Absence of population data limits the ability to undertake epidemiological statistical analysis. With the planned introduction of the SIGMA approach in 2024 to collect data on 2023 AI surveillance activities, **RCs will have the opportunity of submitting data on their poultry population** and give EFSA the possibility of producing outputs more informative for risk managers.

In 2022, a total of 22,171 PEs were sampled, fewer than the number sampled in the previous year ($n = 24{,}290$ PEs). Among those sampled, 18,490 used serological and 3775 used virological assays, while some used both methods. However, as some data were submitted in aggregated form, the number of PEs surveyed using both methods is not able to be calculated.

The number of PEs sampled for the **serological surveys** varied across RCs and ranged from 4763 in the Netherlands to no serological survey in France and United Kingdom (Northern Ireland) Conventional laying hen, fattening turkey and breeding chicken establishments were the most targeted poultry categories by the RCs, while growers were targeted by only two RCs. No poultry categories were sampled by all RCs. Overall, conventional laying hens were the most frequently sampled poultry category ($n = 3629$), followed closely by backyard flocks and free-range laying hens ($n = 3625$ and $n = 2796$, respectively).

A total of 15 PEs were seropositive to either influenza A(H5) or A(H7) viruses (hereafter referred to as A(H5/H7) viruses). However, differently from previous years, all influenza A(H5/H7)-seropositive PEs in 2022 were positive to the A(H5) subtype only. Four countries reported A(H5)-seropositive PEs: Belgium, Poland, Spain and Sweden. Italy, the Netherlands and Romania accounted for more than 60% of all sampled PEs reported. However, as in 2021 no positive PEs were found. The A(H5/H7) seropositivity rate in 2022 (0.08%) seems to suggest a decreasing trend over time (0.11% in 2021, 0.21% in 2020) since the HPAI A(H5) outbreaks in 2016 and with the significant exception of 2019.

Similarly, as in 2021, waterfowl game birds and breeding geese were the poultry categories reported with the largest proportions of A(H5/H7)-seropositive PEs (6.3% and 4.6%, respectively). The proportion of A(H5/H7)-seropositive PEs was below 1% in fattening ducks, backyard flocks and conventional and free-range laying hens. No positive PE was found in the remaining 10 poultry categories. Although, backyard flocks and laying hens (conventional and free-range) accounted for the largest numbers tested, only 2, 2 and 1 seropositive PEs were identified, respectively.

The number of PEs sampled for the **virological surveys** presented a heterogeneous distribution among RCs and ranged from 1 in Malta to 2216 in France. Backyard flocks, broiler (at heightened risk) and game bird (gallinaceous) were among the most targeted poultry categories (by at least nine RCs each), while breeding turkeys were targeted only by France. Across all RCs, broilers (at heightened risk) were the most frequently sampled poultry category ($n = 905$), followed by conventional laying hens ($n = 807$).

A total of 74 PEs were positive in a virological assay to influenza A(H5/H7) viruses with a positivity rate of 1.96%. Ten countries reported A(H5) positive PEs: Italy, Spain, Bulgaria, United Kingdom (Northern Ireland), Portugal, Norway, Iceland, Slovakia, Cyprus and Sweden.

France accounted for 58.7% of all sampled PEs reported, but none of the positive samples. For the purposes of the annual report, France decided to use only the analytical surveillance data linked to the lifting of the restricted zones, given that these zones were located in the parts of the territory most at risk, with the highest poultry densities and the areas most affected by the crisis. No serological survey was carried out by France in 2022.

Growers, fattening geese, fattening turkeys and backyard flocks were the poultry categories with a rate of A(H5/H7) positive PEs greater than 4% by virology. This proportion was lower in breeding chickens, game birds (waterfowl), conventional laying hens, other, broilers (at heightened risk), game bird (gallinaceous), fattening ducks, free-range laying hens. No positive PE was found in the remaining four poultry categories. Although, broilers (at heightened risk) and laying hens (conventional) accounted for the largest numbers tested (45% of PEs), they accounted for only 22% of positive PEs (5 broiler and 11 layer PEs).

## 1.2 | Surveillance in wild birds

Thirty-one RCs, including 27 member states, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) reported results from surveillance of AIVs in wild birds in 2022. The surveillance in wild birds, for obvious reasons, can hardly be based on representative sampling but rather on sampling and testing birds found dead or injured or with clinical signs. As a consequence, the results presented here cannot be extrapolated to the source populations. Comparisons are valid for the specific observations (surveillance samples) only and cannot be used to imply differences between species, locations or years. Consistently with previous reports, wild birds 'found dead' or 'alive with clinical signs' (including injured wild birds) were classified under passive surveillance, while birds reported as 'hunted with clinical signs', 'hunted without clinical signs' and 'alive without clinical signs' were considered as wild birds sampled by active surveillance activities.

Results were reported for a total of 32,143 wild birds, including 22,099 wild birds sampled by passive surveillance. Compared to 2021, the total number of wild birds sampled in 2022 was larger due to a greater contribution of passive surveillance. Within RCs, the numbers of wild birds sampled by passive surveillance ranged from 31 wild birds in Slovakia to 4600 in Germany.

The proportion of wild birds sampled by quarter in 2022 was consistent across all four quarters of the year and ranging between 19% and 31% of all wild bird sampling. The monthly distribution of sampling within RCs was highly variable.

More than 80% of all wild birds sampled were fully identified at a species level (18,502 birds). These wild birds belonged to 346 species distributed across 27 orders. The largest number of samples originated from wild birds of the order Anseriformes ($n = 6234$). The orders Charadriiformes, Passeriformes, Accipitriformes and Columbiformes were also sampled in large numbers ($n > 1500$). Forty-seven of the fifty species listed by EFSA as targets for HPAI surveillance (Table F.1 in Appendix F) were sampled in 2022. The proportion of wild birds belonging to these target species was 36.6% and 41.1% among passive and active surveillance samples, respectively.

A total of 5147 wild birds tested positive for AIVs: 4163 for HPAIVs and 984 for LPAIVs (including non-A(H5/H7) subtypes AIVs). The largest number of HPAIV detections were identified as HPAI A(H5N1) (3955 out of 4163 HPAIV-positive wild birds). The 3 species with the largest proportions of HPAIV-positive wild birds were *Larus argentatus* (European herring gull), *Morus bassanus* (northern gannet) and *Branta leucopsis* (barnacle goose). In 2022, the identification of HPAIVs in wild birds occurred 1.8 times more frequently than in 2021 (from 2314 wild birds in 2021 to 4163 in 2022). The proportion of HPAIV-positive wild birds was 1.6 time higher in 2022 than in 2021. Among the HPAIV-positive wild birds, the number of diverse wild bird species was 1.4 higher in 2022 than in 2021 The geographical distribution of HPAIV-positive wild birds also increased from 2021 to 2022, with detections in 26 countries compared to 23 in 2021. The five RCs who did not report HPAIV-positive wild birds in 2022 were Bulgaria, Lithuania, Luxembourg, Malta and Slovakia.

HPAIV-positive wild birds were detected continuously throughout the year with at least 7% of the sampled wild birds being HPAIV-positive every week. These results contrast with the seasonal fluctuation observed in the previous HPAI A(H5N8) and HPAI A(H5N1) epidemics affecting both poultry and wild birds, in 2020–2021 and 2021–2022, respectively. Previously, the last major HPAI epidemic reported in Europe was in 2016–2017. After a low circulation of HPAIVs in 2018 and 2019, the risk significantly increased in late 2021 and remained high throughout the continent in 2022, indicating a probable endemic circulation in Europe.

The 984 LPAIV-positive wild birds were reported by 20 RCs. Positivity rates were the lowest in spring (March to May), while most LPAIV-positive wild birds were detected from August onwards. Passive surveillance activities accounted for 53% of LPAIV detections compared to active surveillance. 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 EuroBirdPortal (EBP). 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 F.1 in Appendix F) 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.10201041). 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.[1] In addition to these HPAIVs identified over the years, LPAIVs[2] 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 are currently supported by Regulation (EU) 2016/429 ('Animal Health Law'), which establishes 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 in effect since April 2021.

## 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, from 2018 onwards, EFSA was requested to provide technical and scientific assistance to the European Commission (EC) to deliver on this mandate. This implies that EFSA has been responsible for the annual surveillance report on AI since 2018.[3] 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.

# 3 | RESULTS

## 3.1 | Poultry

### 3.1.1 | Poultry establishments sampling for avian influenza surveillance

Twenty-seven MSs, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland), here referred to as RCs, reported results from their surveillance activities in PEs in 2022. Data on the total number of PEs present in each 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 22,171 PEs were sampled as part of the RCs' surveillance programmes. In this report, the numbers reported as 'PEs sampled' should be treated with caution as they refer to the total numbers of sampling events taking place in all PEs and on distinct dates for a specific poultry category, (see Methods section for further details). Thus, the number of distinct PEs where sampling was performed may be lower than the total number of PEs sampled mentioned in the report (i.e. some

[1]Avian influenza overview May 2020 – September 2021, https://doi.org/10.2903/j.efsa.2022.7122

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

[3]The annual report on surveillance for avian influenza in poultry and wild birds in 2018 is available at https://doi.org/10.2903/j.efsa.2019.5945

PEs may have been sampled more than once). Such definition of PEs was important, as not all RCs are submitting surveillance data in a disaggregated manner.

Sampling is mainly carried out under European funding ('EU co-funded active surveillance' in Figure 1). However, Iceland, Norway, Switzerland and Spain also reported surveillance results from their national programmes (non-EU co-funded programmes) and Iceland also reported results obtained by private industry sampling (Figure 1). MSs are not obliged to report surveillance results from surveillance activities other than the EU co-funded active surveillance. For the purposes of the annual report, France decided to use only the analytical surveillance data linked to the lifting of the restricted zones, given that these zones were located in the parts of the territory most at risk, with the highest poultry densities and the areas most affected by the crisis.

In 2022, the total number of PEs sampled was similar to 2021 for most countries (variation under 25%), except for nine RCs. France, Italy, Bulgaria, Denmark, Switzerland and the United Kingdom (Northern Ireland) had steep increases in the number of PEs surveyed while Estonia, Hungary and Portugal saw a steep drop in their numbers.

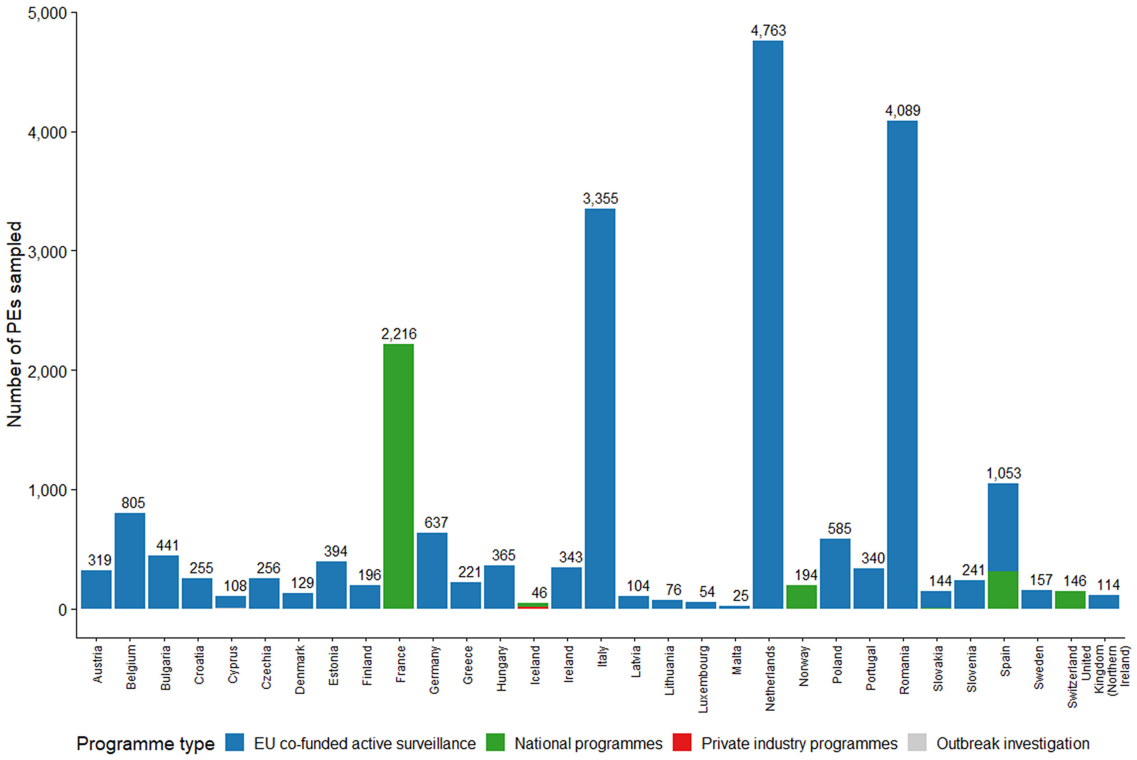


**FIGURE 1** Number of PEs sampled by RCs (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) in 2022 according to the type of active surveillance programme for which results were reported to EFSA.

Virological and serological surveys presented high diversity across countries and species categories. This diversity is expected in any risk-based surveillance system and is illustrated by Figure 2 for the serological survey and Figure 3 for the virological survey.

Serological and virological results are presented in Sections 3.1.2 and 3.1.3, respectively. These sections present an overview of the total number of PEs sampled by each RC and for each poultry category in Figures 8, 12, for serology and Figures 15, 19, for virology. Unlike 2021, Muscovy ducks do not appear in any of the figures as this poultry category was not sampled by any RCs in 2022.

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

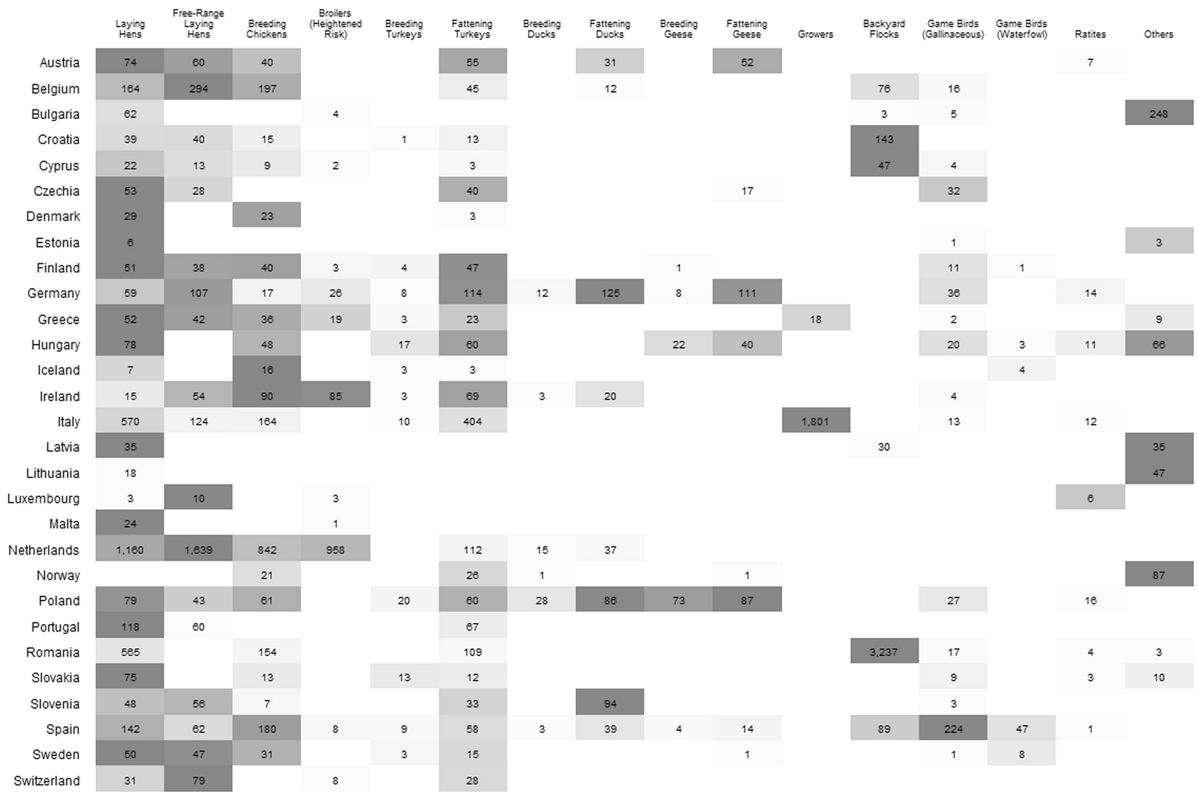


**FIGURE 2** Total number of PEs sampled for serology, presented by RCs (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) and poultry category, according to 16 poultry categories. The different shades are used to indicate the poultry categories with the smallest (lightest grey shade) to the largest (darkest grey shade) number of PEs sampled within a given RC.

Concerning serological surveys, the most frequently targeted poultry categories (i.e. tested by the largest number of RCs), were conventional laying hens ($n = 28$), fattening turkeys ($n = 23$), breeding chickens ($n = 20$) and free-range laying hens ($n = 18$) (Figure 2). However, conventional laying hens, backyard flocks and free-range laying hens were the three most sampled poultry categories (cf. Section 3.1.2, Serology, Figure 12). Only 2 countries reported sample collection from growers[4] (Italy and Greece). Between 5 and 17 RCs reported surveillance results for the following poultry categories: breeding and fattening ducks, breeding turkeys, backyard flocks, waterfowl and gallinaceous game birds, ratites, broilers at heightened risk, breeding and fattening geese and others.

Concerning virological surveys, the most frequently targeted poultry categories (i.e. tested by the largest number of RCs), as described in (Figure 3) were others ($n = 11$), backyard flocks ($n = 10$), broiler (at heightened risk) ($n = 9$) and game bird (Gallinaceous) ($n = 9$). Only France reported sample collection from breeding turkeys. Broiler (at heightened risk), conventional laying hens and others were, however, the three most sampled poultry categories (cf. Section 3.1.3, Virology, Figure 19).

[4]For the purpose of this report, growers are defined as PEs (different species) in which poultry are reared for only part of their productive cycle, production cycle, while they will later be sold to other farms for the completion of their production cycle (i.e. meat/eggs) (Brouwer et al., 2018).

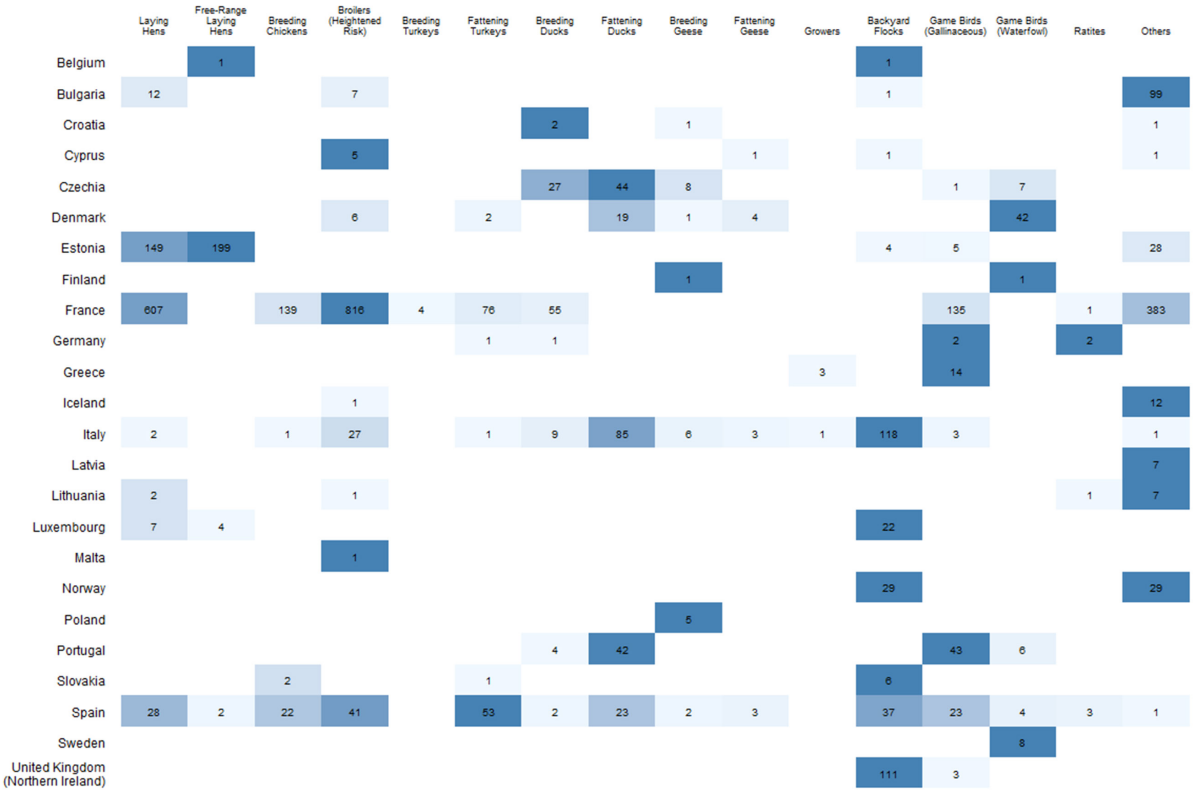


**FIGURE 3** Total number of PEs sampled for virology, presented by RCs (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) and poultry category, according to 16 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.

#### 3.1.1.1 | *Spatial coverage of poultry survey*

Surveillance activities in poultry were reported for 29 NUTS2 (Nomenclature of Territorial Units for Statistics, level 2) units and 716 NUTS3 units in 2022. Reporting at NUTS2 level was linked to surveillance activities in Belgium, Italy and Norway. Out of the 22,171 PEs sampled, 4209 were reported at NUTS2 level and 17,962 at NUTS3.

Figure 4 shows the geographical distribution of surveillance activities in 2022. Data are presented at the NUTS level of reporting (i.e. maps show a combination of NUTS2 and NUTS3 units). The sampling density is estimated as the number of PEs sampled per 100 $km^2$ within a NUTS region.

In 2022, most RCs sampled across most of their NUTS regions, covering the whole European territory as in 2021. However, two countries saw major changes in their spatial distribution (Figure 4):

- Hungary reported samples from all its NUTS3 regions in 2022 when they only sampled central NUTS3 regions in 2021.
- France reported sampling activities mainly in the western half of its territory unlike 2021 where the distribution of the activities covered almost all its territory.

Spatial distribution of sampling activities across Europe varies depending on the nature of the survey used as illustrated in Section 3.1.2 (Serology, Figure 9) and Section 3.1.3 (Virology, Figure 16), respectively.

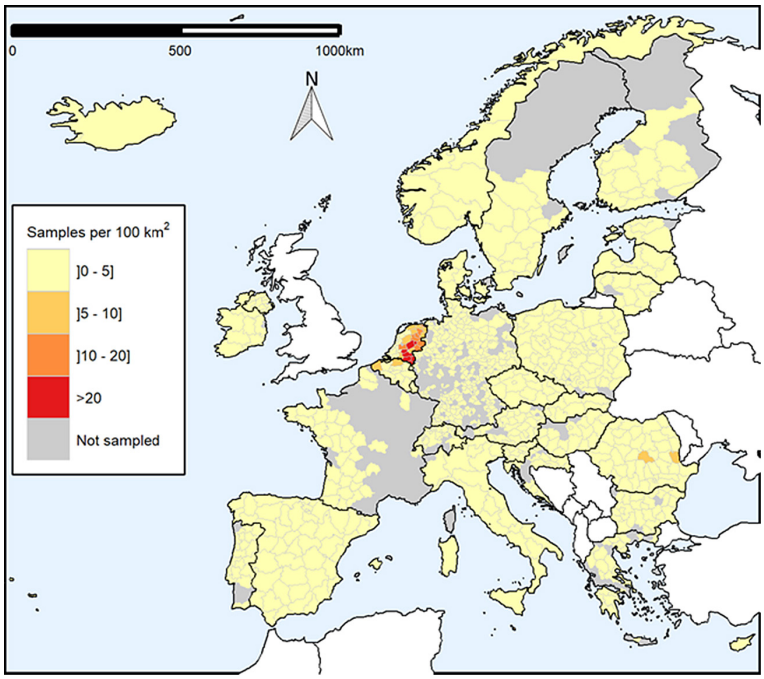


**FIGURE 4** Sampling density expressed as the number of PEs sampled for serology and virology per 100 km$^2$ by administrative unit. Non-reporting countries are shown in white (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.).

#### 3.1.1.2 | *Temporal distribution of poultry survey*

Monthly distribution of surveillance activities in poultry varied highly among RCs as shown by Figure 5. Across countries, there are no similarities between the monthly variation of virological and serological survey activities. All RCs except 3 conducted sampling activities during both halves of the year (Figure 5). Bulgaria and Hungary concentrated their sampling in the second half of the year while the United Kingdom (Northern Ireland) concentrated its sampling to the summer months (June, July and August). For countries that carried out both virological and serological survey, different patterns can be observed. The majority (Bulgaria, Czechia, Greece, Iceland, Italy, Latvia, Lithuania, Luxembourg, Norway, Poland, Portugal, Slovakia, Spain and Sweden) used both surveys throughout the year. Cyprus, Finland and Malta sampled PEs using serology surveys throughout the year but virology assays only during the second half of the year. Denmark switched from sampling PEs exclusively using serology assays in January 2022 to exclusively virology from March 2022 onwards.

The monthly distribution of the serological and virological surveillance activities by poultry category is shown in Figure 6, where a heterogenous distribution of both testing types can be seen. The scale of the vertical axes is specific to each poultry category. Breeding turkeys, growers, ratites and fattening geese were surveyed using only virology assays for only a few months in the year (1–6 months), while all the remaining poultry categories were surveyed using both assays throughout the year. When both survey methods were used the following PE categories were more often surveyed by virology than serology: breeding ducks, game bird (waterfowl) and others.


**FIGURE 5** Monthly number of PEs sampled by RCs (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.) and test type in 2022, reflecting heterogeneity in sampling efforts. The scale of the vertical axes varies by country.

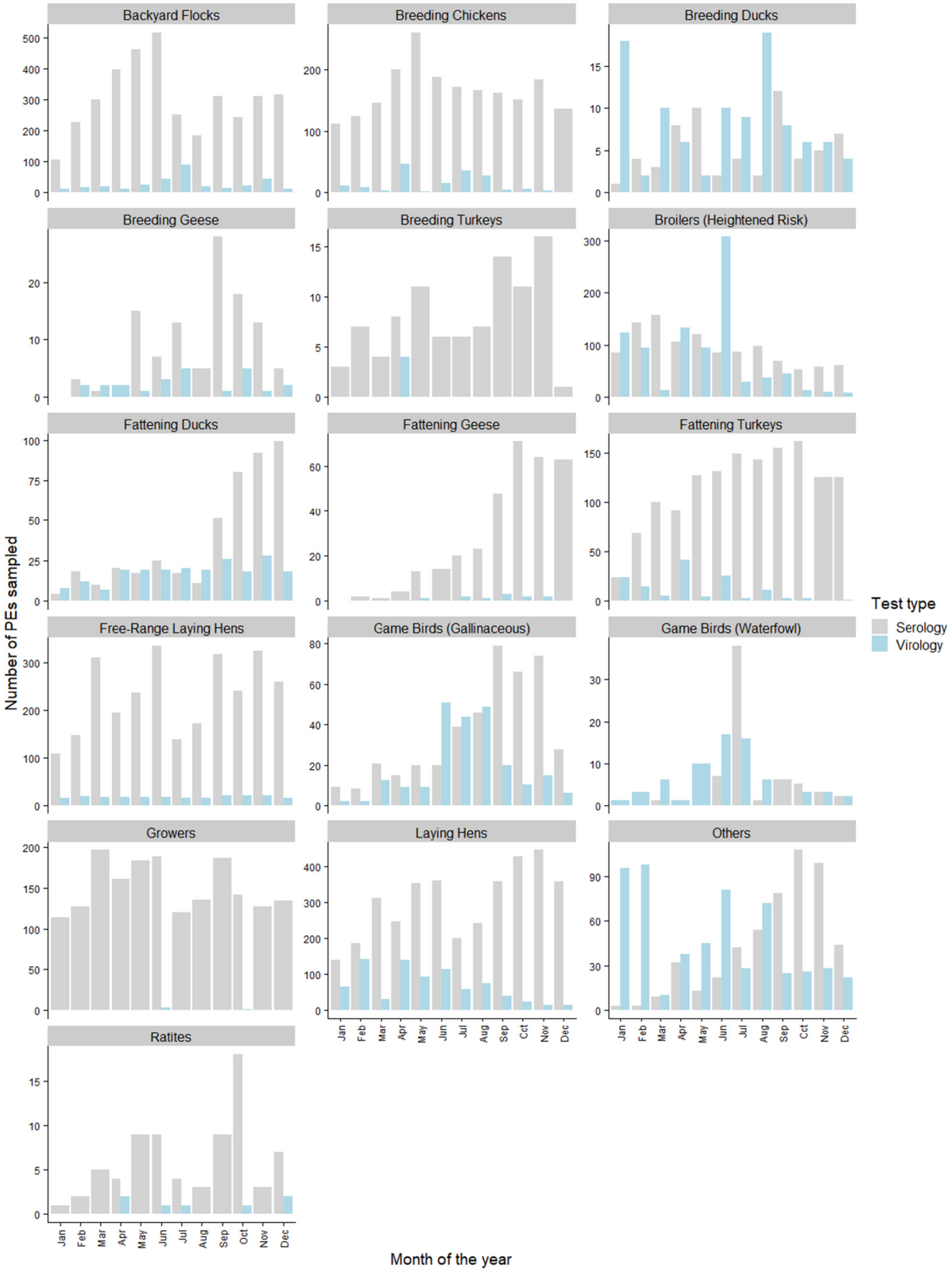


**FIGURE 6** Monthly number of PEs sampled by poultry category and test type in 2022, reflecting heterogeneity in sampling efforts. The scale of the vertical axes varies by poultry category.

## 3.1.2 | Avian influenza in poultry – results from serology

### 3.1.2.1 | *Serological test results overview*

In previous reports, interpretations of temporal trends are based on the assumption that both sampling strategies and targeting remain constant in all RCs throughout the years. With the introduction of virological surveys by the Commission Delegated Regulation (EU) 2020/689 which took effect in April 2021 (Figure 7), this assumption can be challenged. Interpretations will therefore be limited compared to previous reports.

In 2022, the total number of PEs sampled and tested by serology was 18,490. This number was lower than in 2021 (Figure 7A). Fifteen PEs were seropositive for influenza A(H5) viruses in 2022 (Figure 7B). None of the PEs sampled tested positive for influenza A(H7). The percentage of A(H5)-seropositive PEs was 0.08%, which is slightly lower than that of the previous year (0.11%).

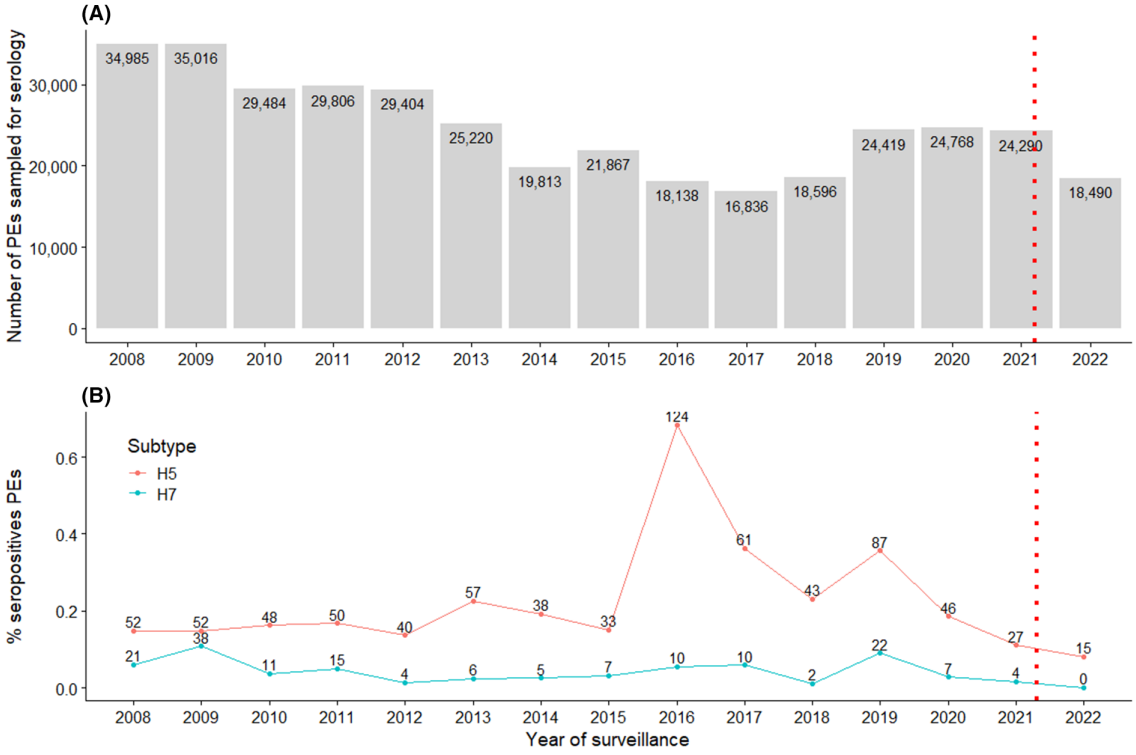


**FIGURE 7** (A) Total number of PEs sampled for serology per year and (B) line graph of the percentage of the PEs seropositive for A(H5/H7) viruses, with the number of seropositive PEs shown per year as labels. The red vertical line represents the change in surveillance strategies based on the Commission Delegated Regulation (EU) 2020/689 which took effect in April 2021.

### 3.1.2.2 | *Serological test results by reporting countries*

As in previous years, considerable variation in the number of PEs sampled was observed among RCs in 2022 (Figure 8). Three countries (the Netherlands, Romania and Italy) accounted for 64.6% of all PEs sampled in 2022. Variations were also observed within RCs (see Section 3.1.2.3, Figure 9). The total number of PEs sampled ranged from 10 in Estonia to 4763 in the Netherlands, with the median number of PEs sampled in RCs being 204. Only 4 countries (Spain, Belgium, Poland and Sweden) reported A(H5)-seropositive PEs ($n = 15$) (Figure 8). No other subtypes were reported.

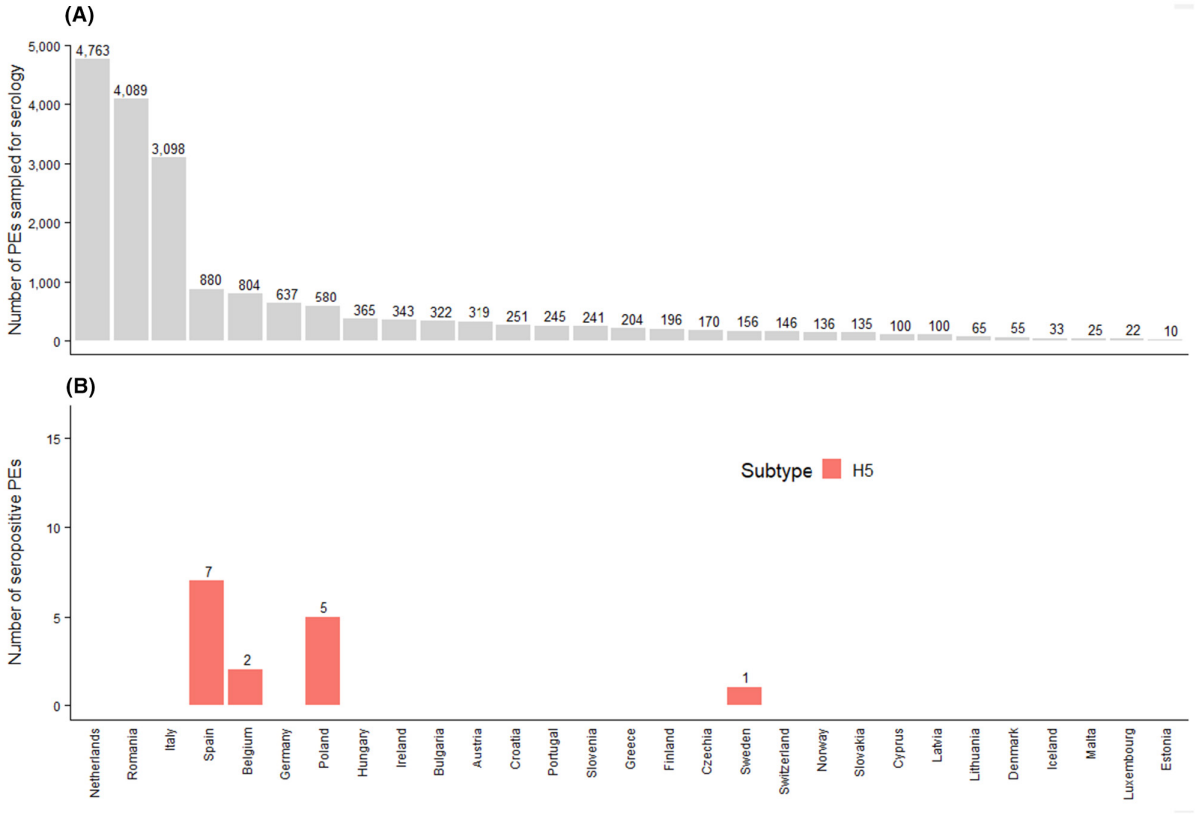


**FIGURE 8** (A) Total number of PEs sampled for serology in 2022 shown by RC (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) in descending order and (B) total number of seropositive PEs found by subtype. (Note: France and United Kingdom (Northern Ireland) are missing from the list as no samples for serology was collected).

#### 3.1.2.3 | *Serological survey results by administrative units*

Figure 9 shows the geographical distribution of serological surveillance activities and the number of A(H5)-seropositive PEs in 2022. 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 $km^2$ within a NUTS region, and distribution of A(H5)-seropositive PEs are presented in Figure 9 in the upper and lower maps, respectively.

Most of the RCs' territories were covered by sampling, with the exception of France, United Kingdom (Northern Ireland), the southern NUTS regions of Portugal, the northern NUTS regions of Norway and Finland, scattered NUTS regions in Germany and some dispersed NUTS regions in other countries. As in previous years, the Netherlands exhibited the NUTS region with the highest sampling density. This distribution differs from the situation in 2021, in which France had sampled a greater number of NUTS regions, while Hungary had sampled fewer. Also in 2021, four additional countries (Italy, the United Kingdom (Northern Ireland) and Bulgaria) had NUTS regions that were sampled in a density exceeding five PEs per 100$km^2$. The distribution of A (H5)-seropositive PEs was limited to one NUTS region for Sweden and Belgium. In Poland, all five seropositive PEs were in different NUTS regions, mainly in the western-northern part of the country. In Spain, the A(H5) PEs were in four different NUTS regions: three in the centre of the country and one in the south. As in 2021, all the A(H5) seropositive PEs in the south of Spain were from the poultry category 'game birds (waterfowl).'

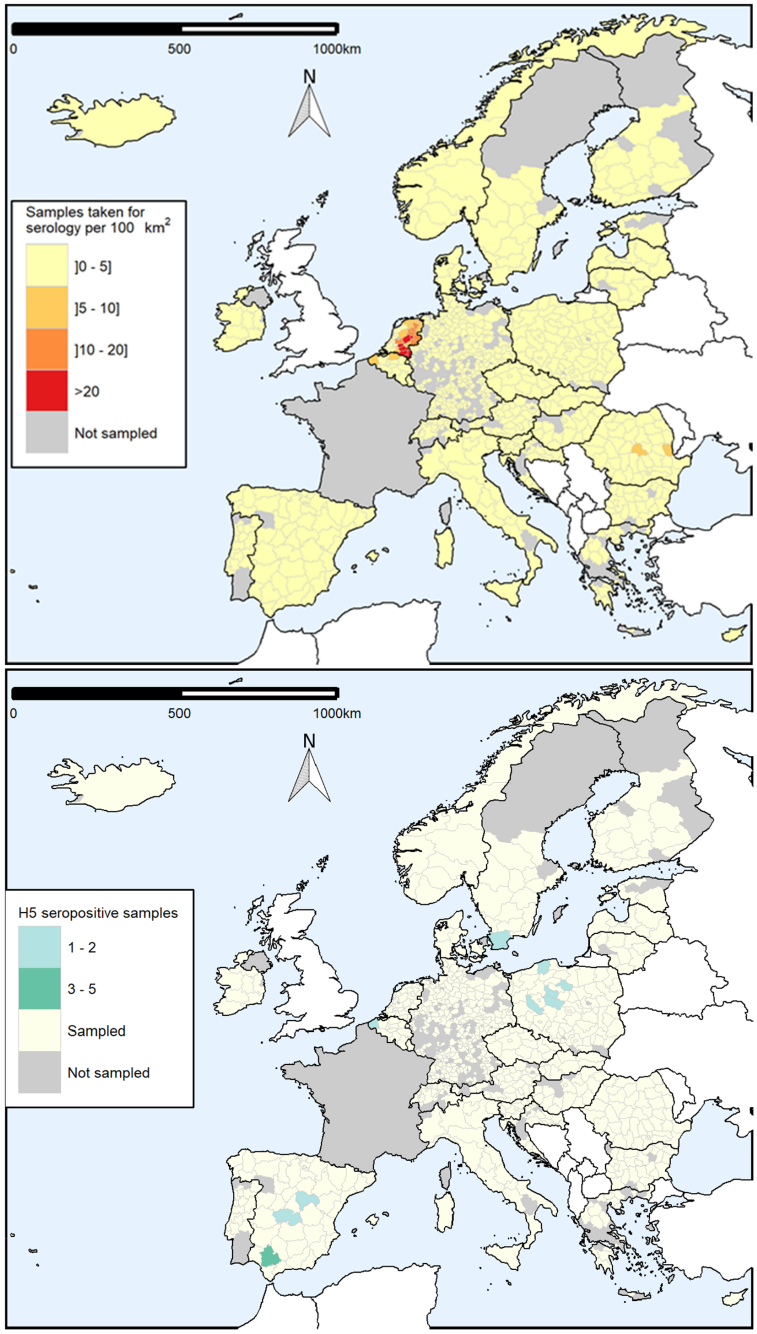


**FIGURE 9** Sampling density expressed as the number of PEs sampled for serology per 100 km$^2$ (upper map) and geographical distribution of A(H5)-seropositive PEs (lower map) by administrative unit. Non-reporting countries are shown in white (In accordance with the Agreement on the Withdrawal of the 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.).

#### 3.1.2.4 | *Serological survey results by month*

The distribution of A(H5)-seropositive PEs by month was homogeneous throughout the year (Figure 10). There was no apparent correlation between seropositivity rates and numbers of PEs sampled. Figure 11 shows the monthly distribution of sampling for the four countries reporting seropositive PEs for influenza A(H5).

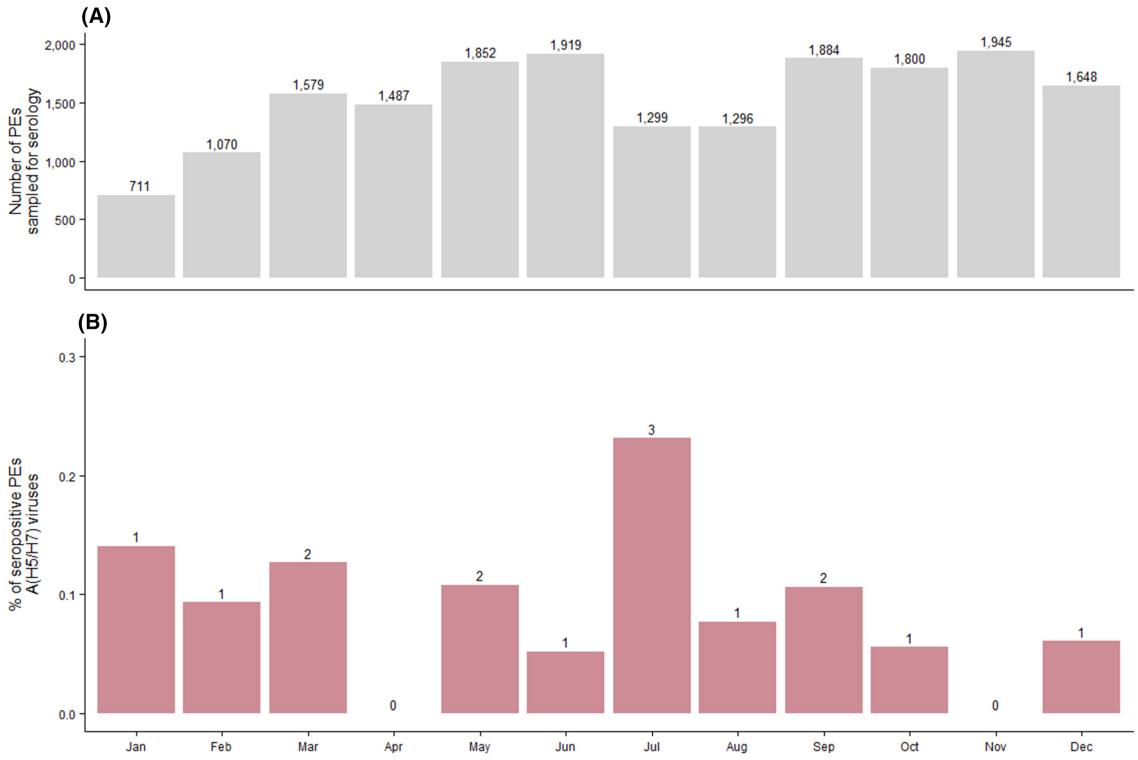


**FIGURE 10** (A) Total number of PEs sampled for serology by month with values above bars referring to the number of PEs sampled. (B) percentage (y-axis) and number (above bars) of PEs sampled that tested seropositive to A(H5/H7) viruses by month.

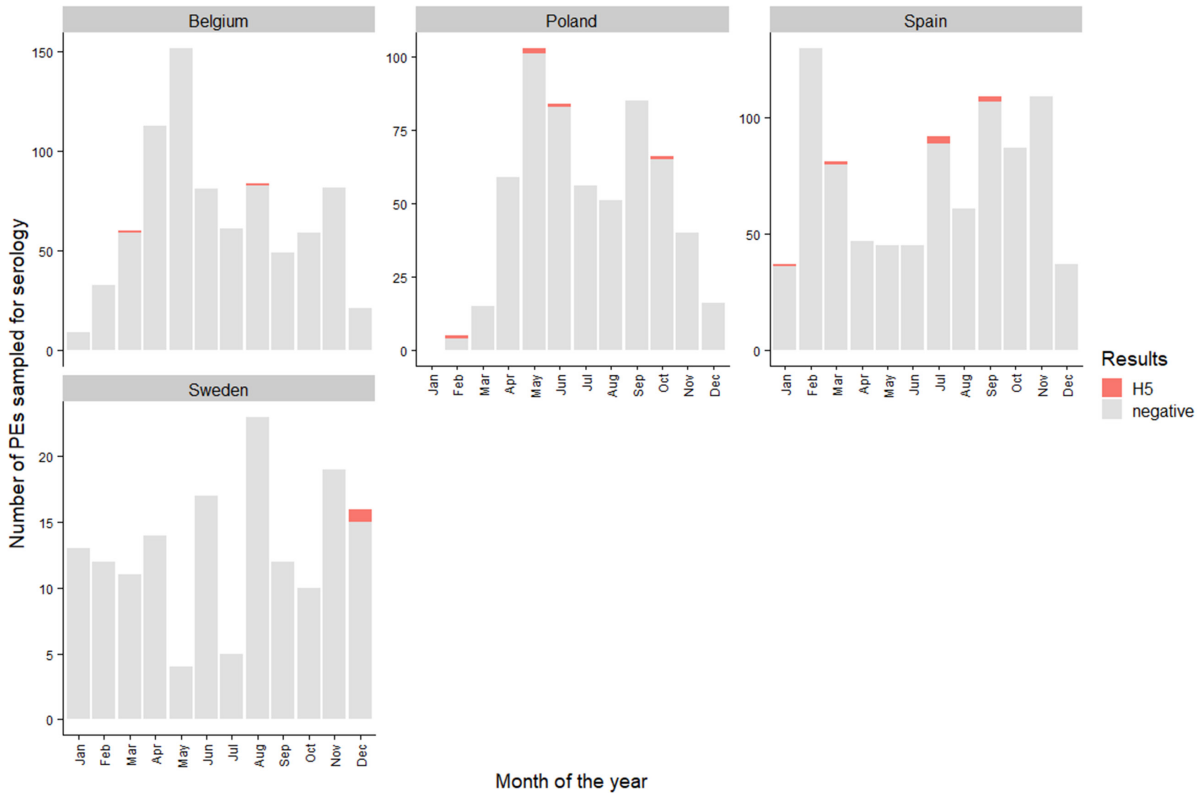


**FIGURE 11** Monthly numbers of PEs sampled for serology and seropositive for influenza A(H5) viruses in 2022, presented for RCs with at least one A(H5)-seropositive PE only. The scale of the vertical axes is specific to each country.

### 3.1.2.5 | *Serological survey results by poultry category*

The highest numbers of PEs sampled by RCs in 2022 belonged to conventional laying hen and the backyard categories ($n = 3629$ and $n = 3625$, respectively) (Figure 12A). These most frequently sampled categories were the same as in previous years. Other categories sampled in large numbers ($n > 1500$) were free-range laying hens, breeding chickens and growers (Figure 12A).

In 2022, unlike 2021 and earlier, the highest proportion of A(H5)-seropositive PEs was found in the waterfowl game bird (6.3% out of 63 PEs sampled) followed by the breeding geese (4.6% out of 108 PEs sampled). Proportions of seropositive PEs were below 1% for all other poultry categories. The fattening duck category had a similar percentage of seropositive PEs compared to the previous year (0.2% out of 444 PEs sampled). When considering only gallinaceous species, the percentages of A(H5)-seropositive PEs were similar for all three categories (backyard flocks, laying hens and free-range laying hens) (all below 0.1%. No A(H5)-seropositive survey results were found in breeding turkeys, breeding ducks, broilers (at heightened risk), breeding chickens, growers, game birds (gallinaceous), fattening geese, ratites and others.

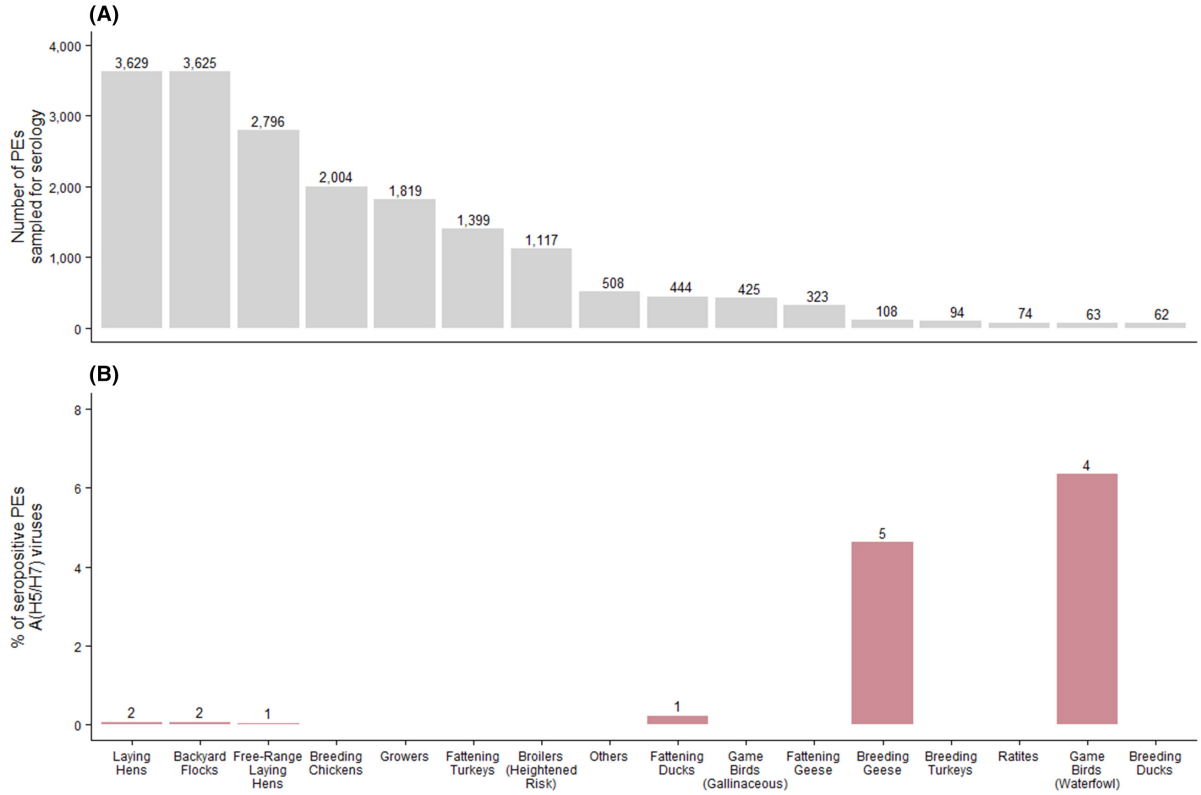


**FIGURE 12** (A) Total number of PEs sampled for serology by poultry category with values above bars referring to the number of PEs sampled, (B) percentage (*y*-axis) and number (above bars) of PEs sampled that tested seropositive for influenza A(H5) viruses by poultry category.

In addition to A(H5)-seropositive survey results, seven RCs reported seropositive PEs for non-A(H5/H7) subtype AIVs[5] (Belgium, Czechia, Germany, Latvia, Luxembourg, Spain and Sweden). There were 223 PEs seropositive to 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 12.

For each poultry category, detailed results by month are shown in Figure 13. Additional surveillance results by species and order are included in Appendix B (Figure B.1). The figure shows that, regardless of the management system, positive PEs were found in Anseriformes (domestic and mallard ducks as well as geese and other Anseriformes), chickens and others. Four seropositive samples were identified in PEs raising game birds from the order Anseriformes, for which the bird species was not available.

[5]Reporting of non-A(H5/H7) subtype AIVs by MSs is non-mandatory.

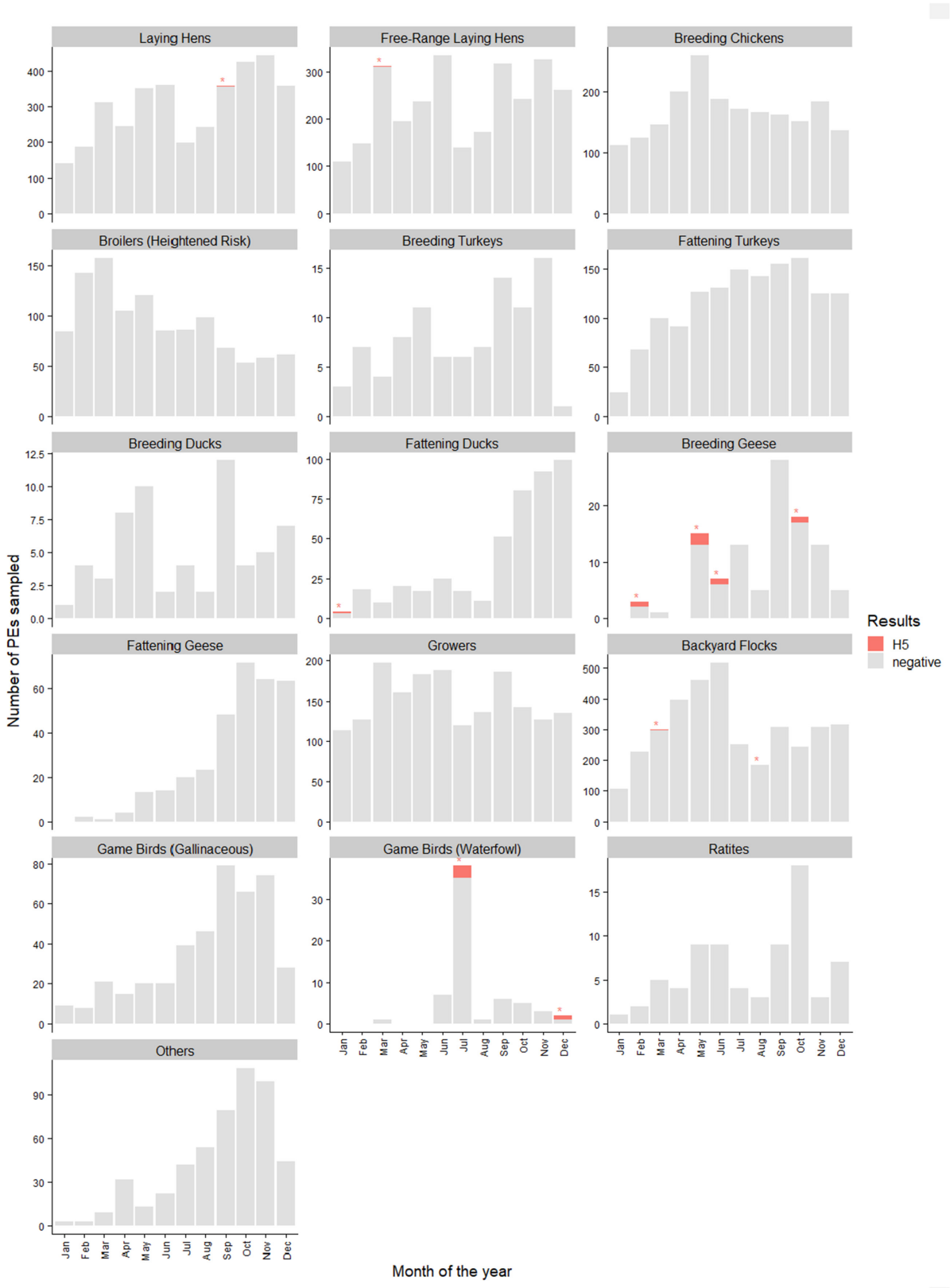


**FIGURE 13** Monthly number of PEs sampled for serology and seropositive to A(H5/H7) viruses in 2022, presented by poultry category. The scale of the vertical axes is specific to each category. Some positive survey results (e.g. in conventional laying hens) are not visible due to the low number of positive PEs during the respective months (e.g. 1 A(H5)-seropositive PE only). The asterisks indicate whether there was at least one positive PE reported for the respective category and month.

### 3.1.2.6 | *Serological survey results: Summary*

Figure 14 shows only the RCs and poultry categories in which A(H5)-seropositive PEs were detected. Spain and Poland were the countries reporting the most A(H5)-positive PEs. These PEs belonged mainly to waterfowl game birds in Spain and breeding geese in Poland.

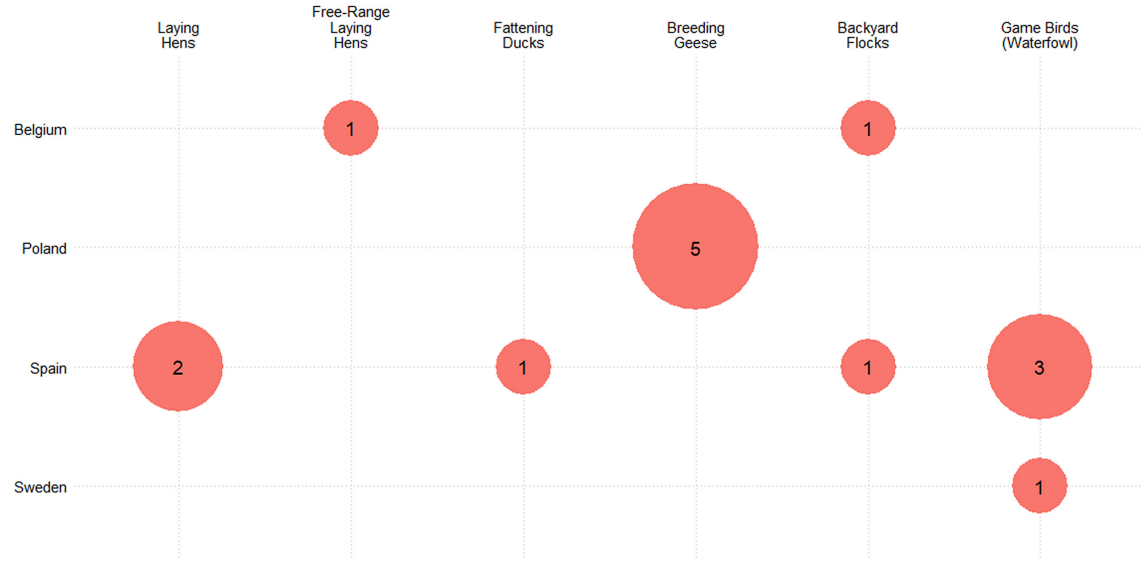


**FIGURE 14** Number of PEs seropositive for influenza A(H5) viruses by RC and poultry category in 2022.

#### 3.1.2.7 | *PCR and virological results of serological positive PEs*

Out of the 15 PEs with positive serological tests for influenza A(H5/H7) viruses, samples from 15 PEs were also tested for AIV viral RNA using PCR, which resulted in three of these PEs testing also positive by PCR:

- two positive PEs, both for the HPAI A(H5) subtype, in conventional laying hens in Spain;
- one positive PE for LPAI A(H5N3) virus in waterfowl game birds in Sweden.

Most of the seropositive PEs were tested by PCR on the same day ($n = 9$), while the remainder were re-sampled for PCR testing on average 11 days after the serological tests. Two virus isolation (VI) results were available for the two PEs producing conventional laying hens in Spain with A(H5)-seropositive and PCR-positive test results.

### 3.1.3 | Avian influenza in poultry – results from virology

#### 3.1.3.1 | *Virological survey results overview*

As in the previous section, comparisons of incidence 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;
- 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 by virology only. The underlying population cannot be used as a denominator. Interpretations of temporal trends are not available as this is first year this surveillance activity is being described in detail.

In 2022, 74 PEs sampled for virological survey were positive for influenza A(H5) viruses. None of the PEs sampled for virological survey were positive for influenza A(H7). The percentage of A(H5)-positive PEs was 1.96% with a total number of PEs sampled taken for virology of 3775.

#### 3.1.3.2 | *Virological survey results by reporting countries*

Considerable variation in the number of PEs sampled was observed among the 24 RCs that reported sampling taken for virological survey in 2022 (Figure 15). By itself France accounted for 58.7% of all PEs sampled using virological surveys. The median number of PEs sampled in RCs was 15 (Figure 15). Ten countries reported A(H5)-positive PEs ($n = 74$ PES) from the virological surveys, while none of the RCs reported A(H7)-positive PEs. With 37 A(H5)-positive PEs, Spain is the country with the highest number of positive samples while France, Estonia, Czechia, Denmark, Luxembourg, Greece, Lithuania, Latvia, Germany, Poland, Croatia, Belgium, Finland, Malta had no positive PEs sampled.

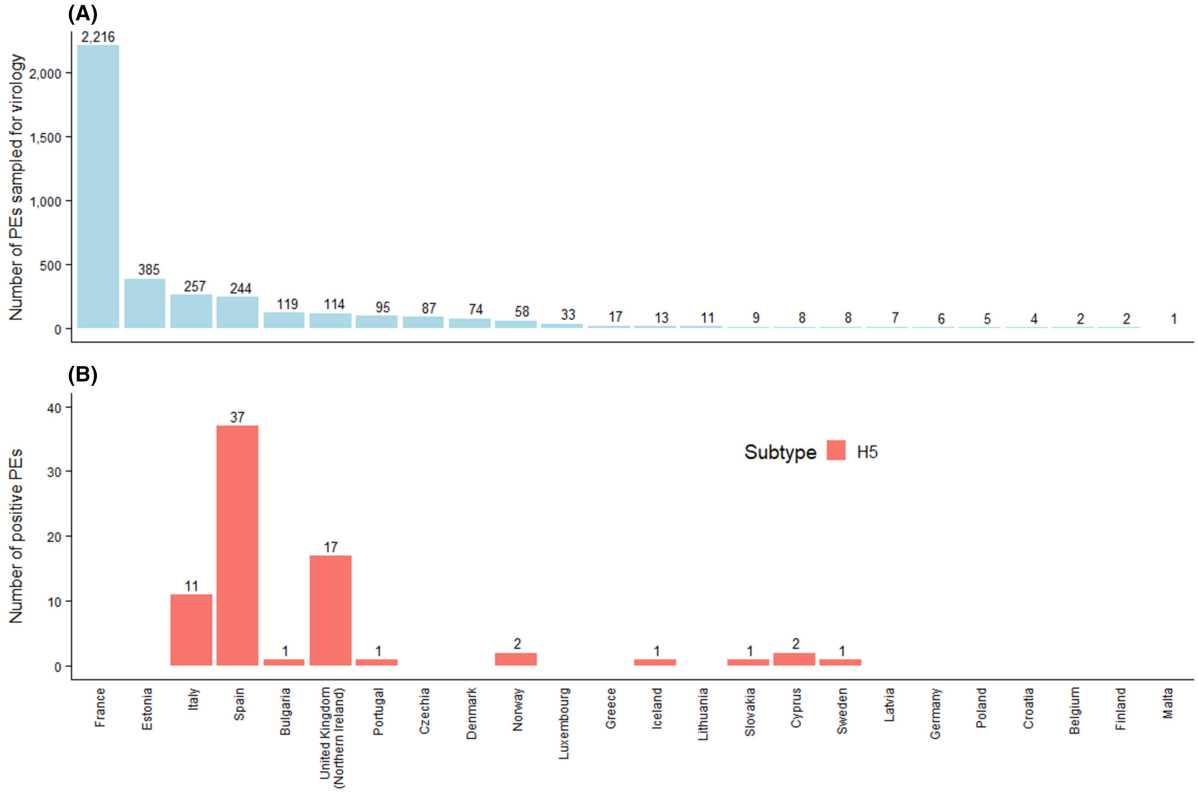


**FIGURE 15** (A) Total number of PEs sampled for virology in 2022 shown per RC (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) in descending order and (B) total number of positive PEs found by subtype.

### 3.1.3.3 | *Virological survey results by administrative units*

Figure 16 shows the geographical distribution of virological surveillance activities and the number of A(H5/H7)-positive PEs in 2022. Data are presented at the NUTS level of reporting (i.e. maps show a combination of NUTS2 and NUTS3 units). The sampling density of the virological surveys, estimated as the number of PEs sampled during for virological survey per 100 $km^2$ within a NUTS region, and distribution of A(H5)-positive PEs are presented in Figure 16 in the upper and lower maps, respectively.

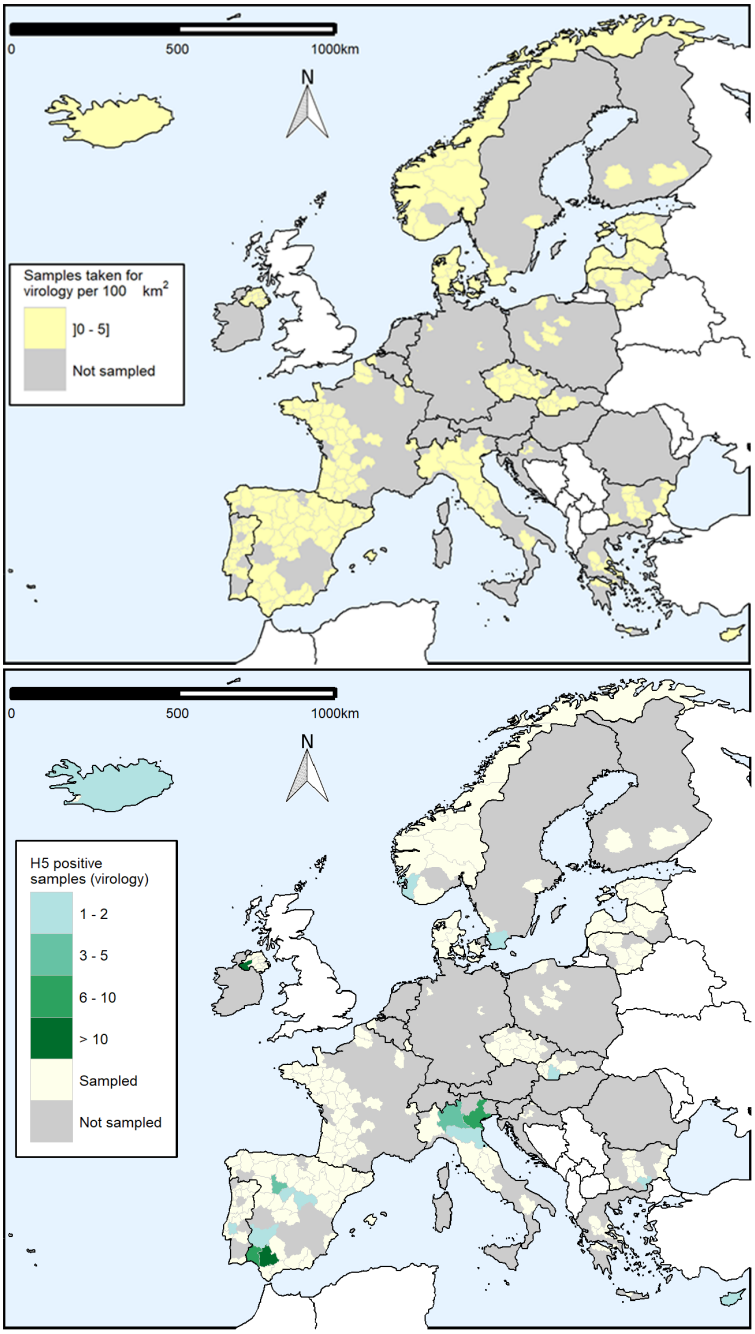


**FIGURE 16** Sampling density expressed as the number of PEs sampled for virological survey per 100 km$^2$ (upper map) and geographical distribution of A(H5)-positive PEs to virological survey (lower map) by administrative unit. Non-reporting countries are shown in white (In accordance with the Agreement 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.).

Spatial distribution of the sampling density varied highly as a few countries did not sample any PEs using virological surveys (Figure 16 upper). Among the 24 RCs who did, Iceland, United Kingdom (Northern Ireland), Norway, Estonia, Latvia, Denmark, Malta and Cyprus sampled most of their NUTS regions using virological surveys. Positive PEs were usually identified in a single NUTS region when a country reported a positive PE. However, Italy and Spain reported each cluster of three adjacent NUTS region with A(H5)-positive PEs sampled for virological survey. The first cluster is in northern Italy, the second in the south-west of Spain and the third cluster in the centre of Spain (Figure 16 lower).

#### 3.1.3.4 | *Virological survey results by month*

The monthly distribution of PEs testing positive for A(H5) viruses by virological survey is not uniform across 2022 with no detections of positive PEs in June and December (Figure 17). There was no apparent correlation between higher positivity proportions and higher numbers of PEs sampled. Proportions of positive PEs to virological survey varied from 0% to 6.7% across the year, while the number of positive establishments varied between 0 and 21 per month. Figures 18 and 19 show the diversity in distribution of A(H5)-positive PEs sampled for virology by country (per month) and by poultry category, respectively.

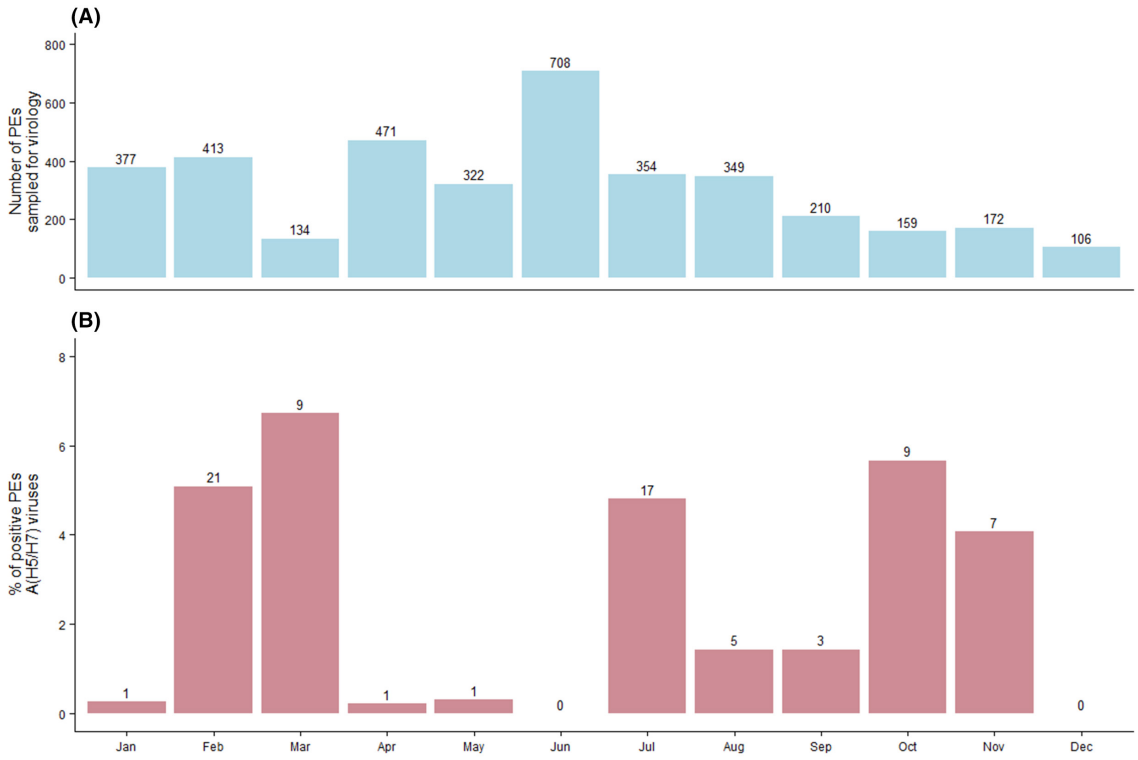


**FIGURE 17** (A) Total number of PEs sampled for virology by month with values above bars referring to the number of PEs sampled. (B) percentage (y-axis) and number (above bars) of PEs sampled that tested positive to A(H5/H7) viruses by month.

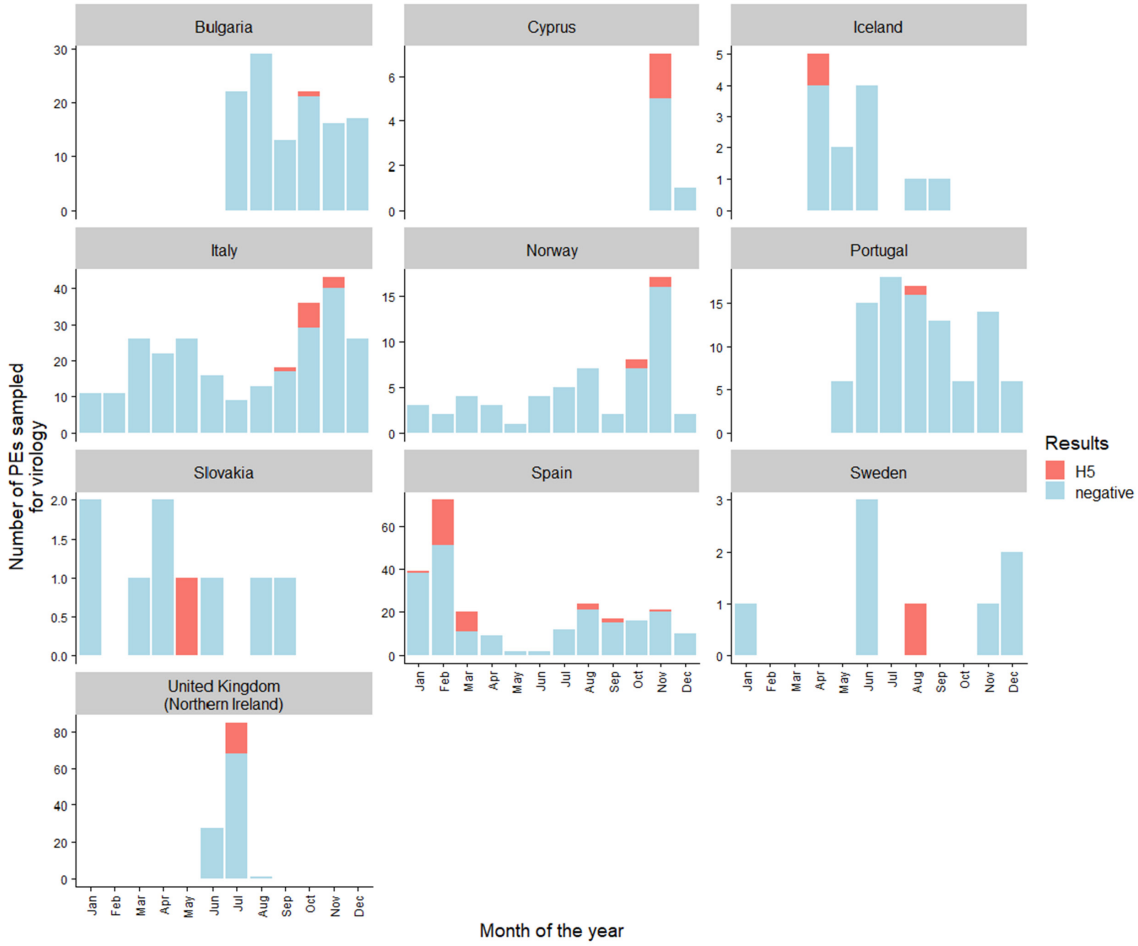


**FIGURE 18** Monthly numbers of PEs sampled for virology and positive for influenza A(H5) viruses in 2022, presented for RCs with at least one A(H5)-positive PE only. The scale of the vertical axes is specific to each country.

### 3.1.3.5 | *Virological test results by poultry category*

The highest numbers of PEs sampled by RCs in 2022 were from the broilers (at heightened risk) and conventional laying hen categories ($n = 905$ and $n = 807$, respectively) (Figure 19A). Other categories sampled in large numbers ($n > 200$) were others, backyard flocks, game birds (gallinaceous), fattening ducks and free-range laying hens. In 2022, the percentage of A(H5)-positive PEs sampled for virological survey varied from 0.4% to 25% between poultry categories. The highest proportion of positive cases was found in two of the five categories with less than 25 PEs sampled: the fattening geese (18.2%) and the growers (25%).

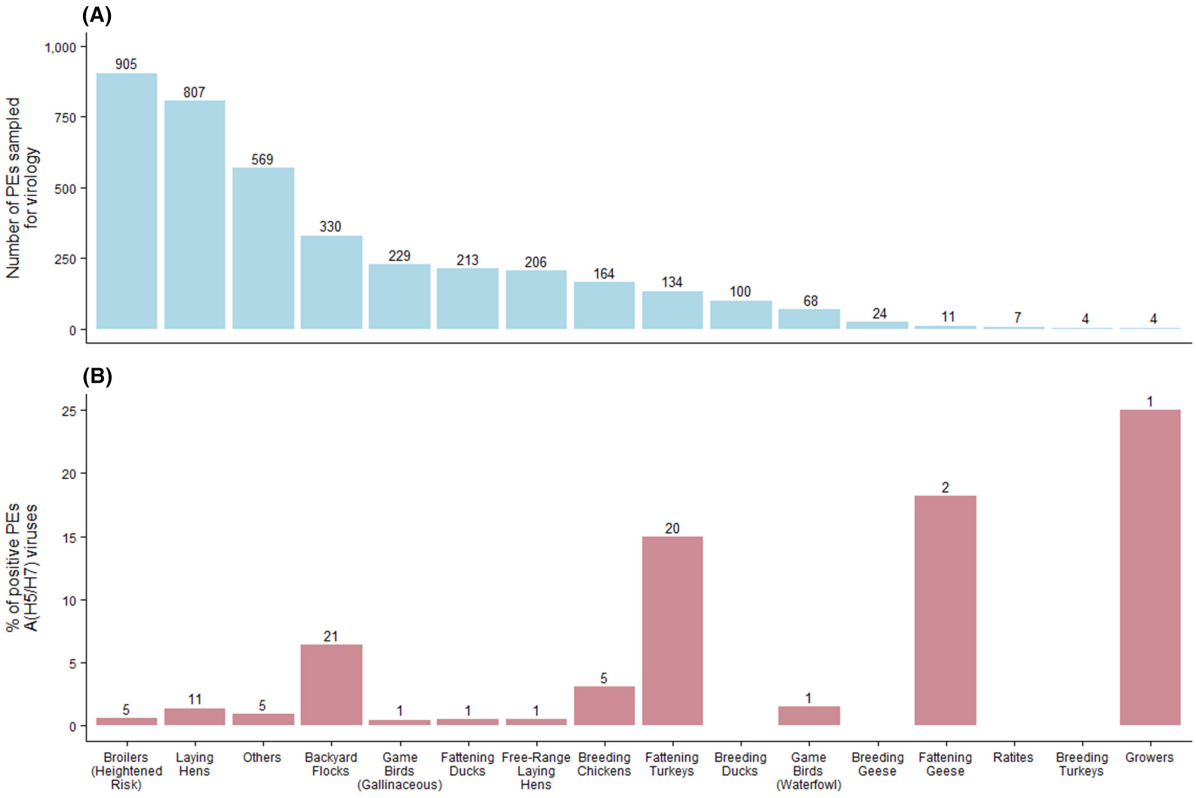


**FIGURE 19** (A) Total number of PEs sampled for virology by poultry category with values above bars referring to the number of PEs sampled, (B) percentage (*y*-axis) and number (above bars) of PEs sampled that tested positive for influenza A(H5/H7) viruses by poultry category.

For each poultry category, detailed results by month are shown in Figure 20. Additional surveillance results by species and order are shown in Appendix C (Figure C.1). The figure shows that, regardless of the management system, positive PEs were found in chickens, Anseriformes (domestic and mallard ducks as well as geese and other Anseriformes), others and guinea-fowl. One positive sample was identified in a PE raising game birds from the order Anseriformes, for which the bird species was not available.

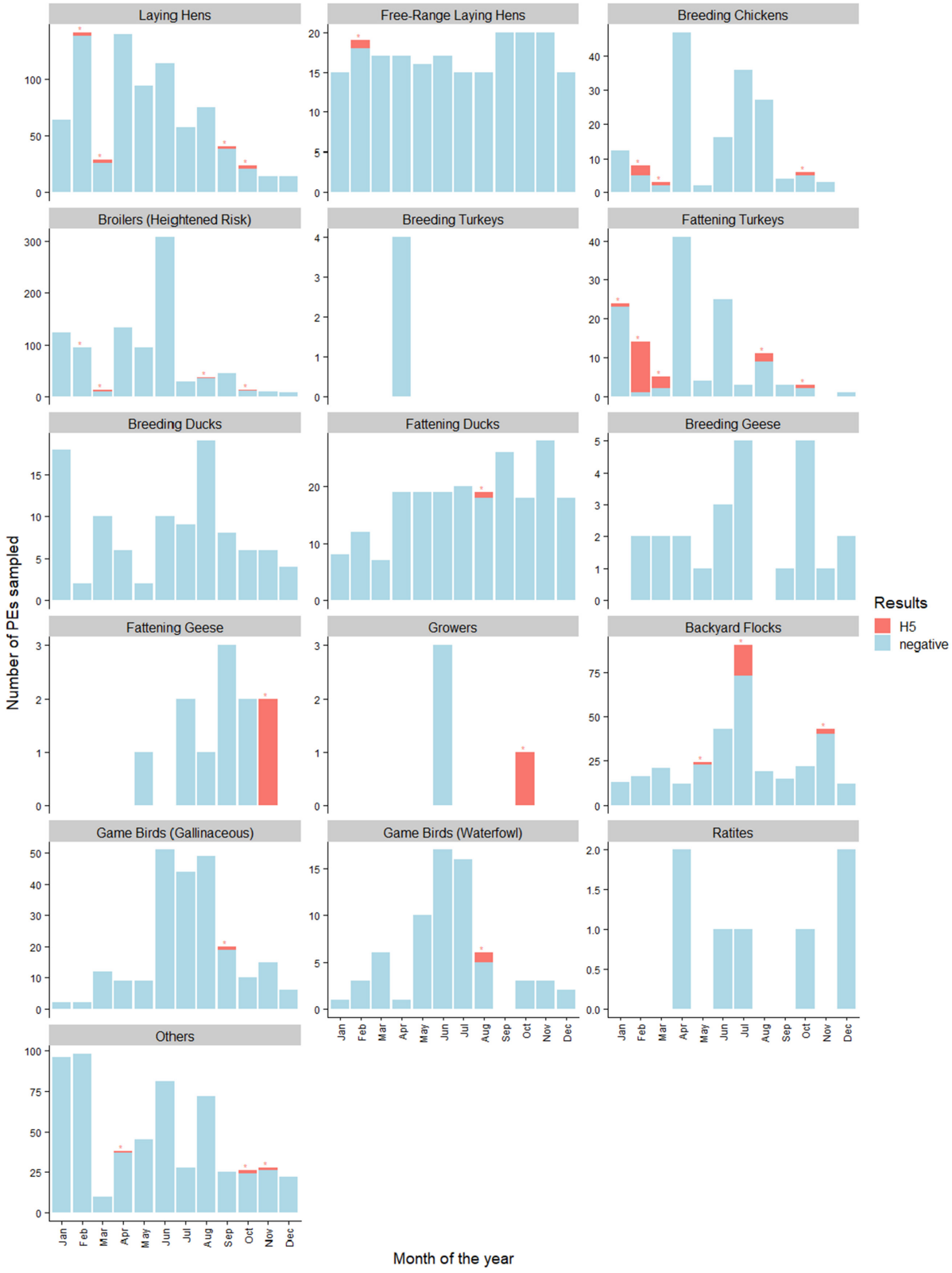


**FIGURE 20** Monthly number of PEs sampled for virology and positive to A(H5/H7) viruses in 2022, presented by poultry category. The scale of the vertical axes is specific to each category. Some positive test results (e.g. in conventional laying hens) are not visible due to the low number of positive PEs during the respective months (e.g. 1 A(H5)-seropositive PE only). The asterisks indicate whether there was at least one positive PE reported for the respective category and month.

### 3.1.3.6 | *Virological test results: Summary*

Figure 21 shows an overview of the number of A(H5)-positive PEs by RC and poultry category through virological testing in 2022. Of all RCs, 12 countries reported detection of AIVs in 12 different poultry categories. Of these countries, 10 reported AIVs in a maximum of two different poultry categories. However, Italy and Spain reported positive cases in eight to six categories, respectively. The majority of A(H5) viruses reported where HPAI A(H5N1) virus, however:

- United Kingdom (Northern Ireland) reported 17 positive PEs for HPAI A(H5N8) viruses in backyard flocks;
- Bulgaria and Slovakia both reported positive PEs for A(H5N1) viruses with unknown pathogenicity in conventional laying hens and backyard flocks respectively;
- Sweden reported three positive PEs for LPAI A(H5N3) viruses in game birds (waterfowls).

Also, as described previously, three PEs (one in Sweden and two in Spain) were also tested by serology and appeared in all figures in the sections describing the serological results.

Three RCs reported positive test results for non-A(H5/H7) subtypes AIVs[6] in poultry (Sweden, Estonia and Croatia). There were six PEs positive to non-A(H5/H7) subtype AIVs, from game birds (waterfowl), others and conventional laying hen. 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.

The sensitivity of virological surveillance activities to detect HPAIV in RCs depends on several parameters, including the size of the poultry population, the 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).

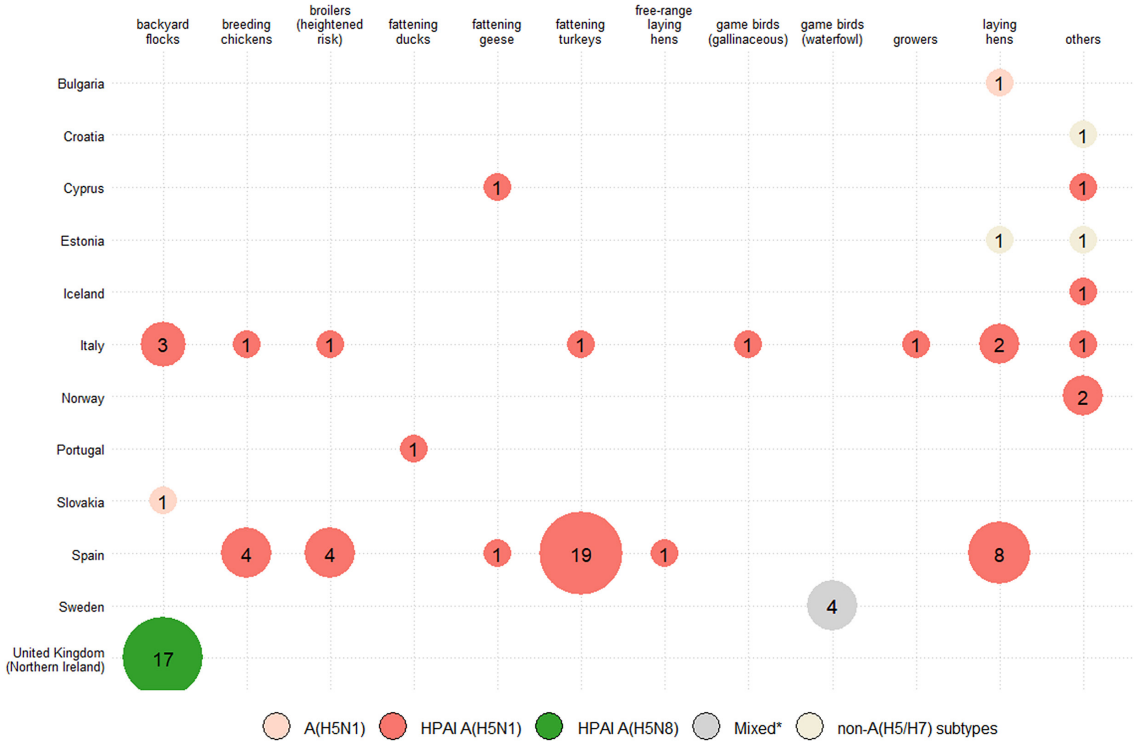


**FIGURE 21** Number of PEs positive for influenza viruses by RC and poultry category in 2022. The asterisk indicates that PEs were positive for different influenza viruses in a specific RC and a poultry category.

## 3.2 | Wild birds

### 3.2.1 | Sampling in wild birds

#### 3.2.1.1 | *Number of wild birds sampled*

In 2022, a total of 32,143 wild birds were sampled by 27 MSs, Iceland, Norway, Switzerland and the United Kingdom (Northern Ireland) (31 RCs) either by active or passive surveillance.

MSs are not obliged to report surveillance results from surveillance activities other than the EU co-funded surveillance activities. Nonetheless, in addition to the sampling carried out under European co-funding, four MSs (Belgium, Germany, Poland and Spain), Iceland, Norway and Switzerland reported surveillance results from their national programmes (see Figure 22).

[6]Reporting of non-A(H5/H7) subtype AIVs by MSs is non-mandatory.

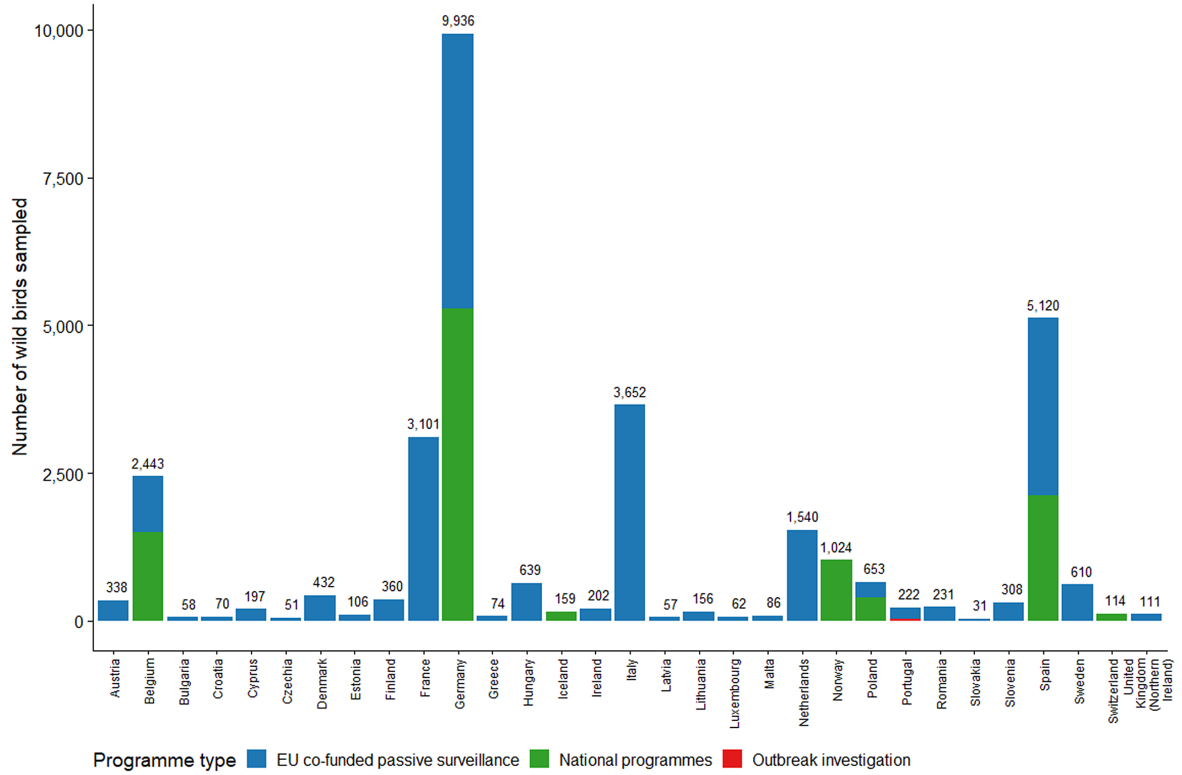


**FIGURE 22** Number of wild birds sampled by RCs in 2022 according to the type of surveillance programme.

For the purpose of this report, wild birds 'found dead' or 'alive with clinical signs' (including injured wild birds) were classified under passive surveillance, while birds reported as 'hunted with clinical signs', 'hunted without clinical signs' and 'alive 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 may choose depending on their risk analysis not to target those populations except for wild birds 'hunted with clinical signs'.

All 31 RCs reported results from their passive surveillance programmes in 2022. Of the total number of wild birds sampled, 22,099 were sampled by passive surveillance, which is greater than in the past 4 years (e.g. $n = 20{,}920$ in 2021) (Table 1). The sensitivity of passive surveillance for AI in wild birds is highly dependent on the probability of discovering and reporting wild birds found dead, injured or with clinical signs.

**TABLE 1** Number of wild birds sampled by RCs in 2022 (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 small numbers or no data reported for active surveillance, the respective RC[a] may have reported only little data to EFSA or not carried out active surveillance at all.

| | Passive surveillance | | | | | Active surveillance | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| Reporting country | 2018 | 2019 | 2020 | 2021 | 2022 | 2021 | 2022 | 2021 | 2022 |
| Austria | 109 | 85 | 183 | 419 | 338 | 0 | 0 | 419 | 338 |
| Belgium | 237 | 423 | 275 | 290 | 944 | 448 | 1499 | 738 | 2443 |
| Bulgaria | 58 | 65 | 70 | 103 | 54 | 13 | 4 | 116 | 58 |
| Croatia | 223 | 160 | 92 | 110 | 70 | 0 | 0 | 110 | 70 |
| Cyprus | 109 | 87 | 137 | 129 | 183 | 7 | 14 | 136 | 197 |
| Czechia | 94 | 104 | 127 | 208 | 51 | 0 | 0 | 208 | 51 |
| Denmark | 148 | 111 | 288 | 760 | 432 | 0 | 0 | 760 | 432 |
| Estonia | 16 | 8 | 3 | 307 | 62 | 12 | 44 | 319 | 106 |
| Finland | 195 | 174 | 222 | 560 | 360 | 0 | 0 | 560 | 360 |
| France | 113 | 158 | 503 | 875 | 3098 | 0 | 3 | 875 | 3101 |
| Germany | 1711 | 1392 | 3041 | 7321 | 4600 | 7844 | 5336 | 15,165 | 9936 |
| Greece | 13 | 12 | 6 | 26 | 64 | 4 | 10 | 30 | 74 |
| Hungary | 371 | 338 | 472 | 228 | 639 | 0 | 0 | 228 | 639 |
| Iceland | | 2 | 9 | 18 | 159 | 0 | 0 | 18 | 159 |

**TABLE 1** (Continued)

| | Passive surveillance | | | | | Active surveillance | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| **Reporting country** | **2018** | **2019** | **2020** | **2021** | **2022** | **2021** | **2022** | **2021** | **2022** |
| Ireland | 142 | 78 | 165 | 265 | 202 | 0 | 0 | 265 | 202 |
| Italy | 2109 | 2719 | 2791 | 4005 | 3652 | 0 | 0 | 4005 | 3652 |
| Latvia | 14 | 15 | 4 | 151 | 57 | 0 | 0 | 151 | 57 |
| Lithuania | 70 | 63 | 139 | 234 | 156 | 0 | 0 | 234 | 156 |
| Luxembourg | | 50 | 135 | 305 | 62 | 0 | 0 | 305 | 62 |
| Malta | | | 9 | 9 | 47 | 42 | 39 | 51 | 86 |
| Norway | | 28 | 128 | 348 | 491 | 800 | 533 | 1148 | 1024 |
| Poland | 36 | 33 | 97 | 649 | 263 | 777 | 390 | 1426 | 653 |
| Portugal | 82 | 126 | 74 | 64 | 182 | 0 | 40 | 64 | 222 |
| Romania | 244 | 201 | 107 | 213 | 224 | 19 | 7 | 232 | 231 |
| Slovakia | 84 | 45 | 83 | 82 | 31 | 0 | 0 | 82 | 31 |
| Slovenia | 178 | 231 | 270 | 323 | 308 | 0 | 0 | 323 | 308 |
| Spain | 344 | 281 | 437 | 732 | 2995 | 490 | 2125 | 1222 | 5120 |
| Sweden | 455 | 456 | 410 | 803 | 610 | 0 | 0 | 803 | 610 |
| Switzerland | 45 | 30 | 55 | 162 | 114 | 6 | 0 | 168 | 114 |
| The Netherlands | 663 | 643 | 878 | 1149 | 1540 | 0 | 0 | 1149 | 1540 |
| United Kingdom | 1282 | 816 | 1208 | | | | | | |
| United Kingdom (Northern Ireland) | | | | 72 | 111 | 0 | 0 | 72 | 111 |
| **Total** | **9145** | **8934** | **12,418** | **20,920** | **22,099** | **10,462** | **10,044** | **31,382** | **32,143** |

[a]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.

Some RCs ($n = 137$) also reported results from active surveillance. In particular, Belgium, Germany, Norway and Poland sampled a higher number of wild birds by active rather than passive surveillance (Table 1). Although active surveillance was carried out in other countries as well, the data shown in this report represents only the data that were submitted to EFSA. As reporting from all active surveillance in wild birds to EFSA is non-mandatory, 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.

#### 3.2.1.2 | *Timing of sampling in wild birds*

In Figure 23, the quarterly distribution of the number of wild birds sampled by passive surveillance in 2022 is shown for each RC. The highest numbers of samples were taken during the third quarter (July–September). The distribution of sampling across the quarter was lower but relatively consistent across all remaining three quarters:

- quarter 1: 5997 wild birds, (27%);
- quarter 2: 4163 wild birds, (19%);
- quarter 3: 6878 wild birds, (31%);
- quarter 4: 5061 wild birds, (23%).

Figure 23 highlights variation among RCs in terms of the sampling distribution throughout the year (percentage of samples taken during each quarter by each RC).

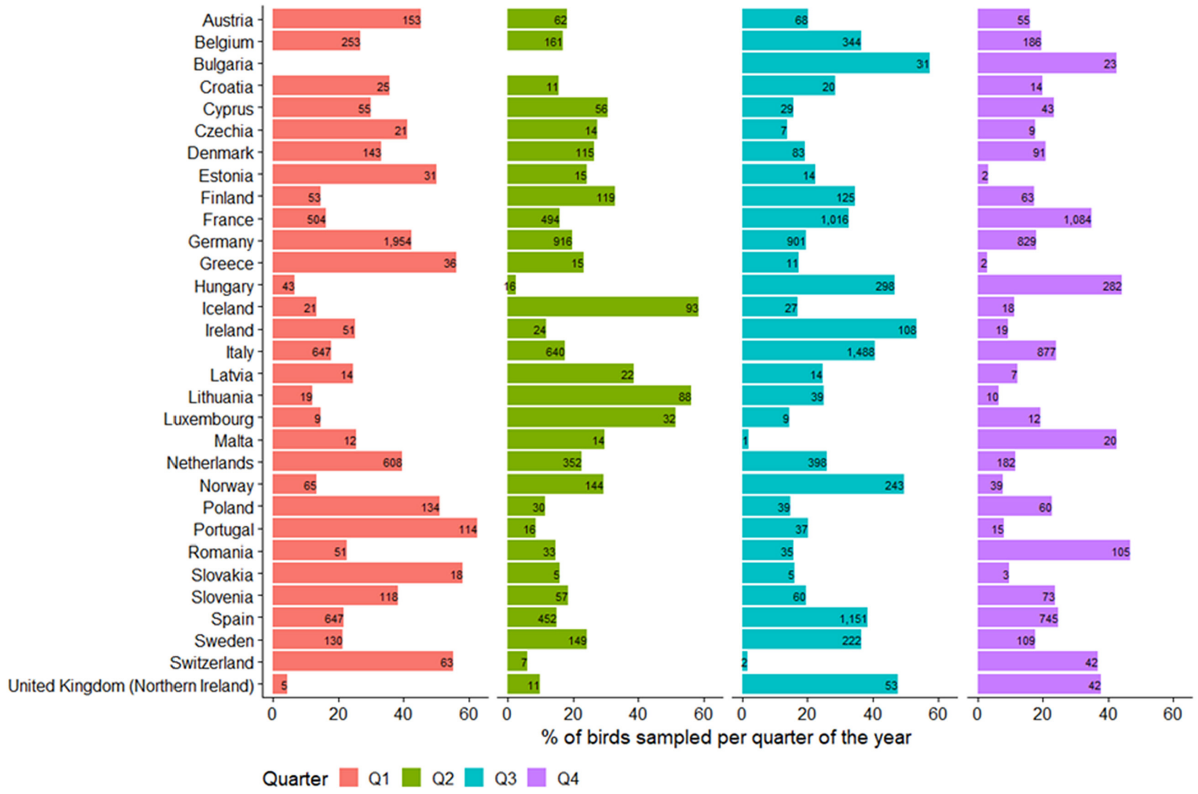


**FIGURE 23** Quarterly percentage (bars) and total numbers (values) of wild birds sampled by passive surveillance by RCs (In accordance with the Agreement on the Withdrawal of the UK from the EU, and in particular with the Protocol on Ireland/Northern Ireland, the EU requirements on data sampling are also applicable to Northern Ireland.) in 2022, with the first quarter starting in January 2022.

### 3.2.1.3 | *Species distribution in wild birds*

Among wild birds sampled by passive surveillance, there were:

- 18,502 wild birds fully identified at the species level. These samples belonged to a total of 346 wild bird species belonging to 27 orders,
- 3355 wild birds for which only the genus was identified but not the species (14 orders),
- 183 wild birds for which only the family was identified but not the species (11 orders),
- 59 wild birds for which only the order was identified (6 orders),
- 0 wild birds for which species identification information was completely missing.

The most frequently sampled order was Anseriformes ($n = 6234$), which accounted for 28.2% of the total number of wild birds sampled by passive surveillance. The orders Charadriiformes, Passeriformes, Accipitriformes and Columbiformes were also sampled in high numbers ($n > 1500$ each) (Figure 24).

Similarly, most active surveillance samples were taken from wild birds of the order Anseriformes ($n = 6734$), which accounted for 67% of the total number of wild birds sampled by active surveillance ($n = 10,044$). The distribution of wild birds sampled by order is shown for active and passive surveillance combined in Appendix D (Figure D.1).

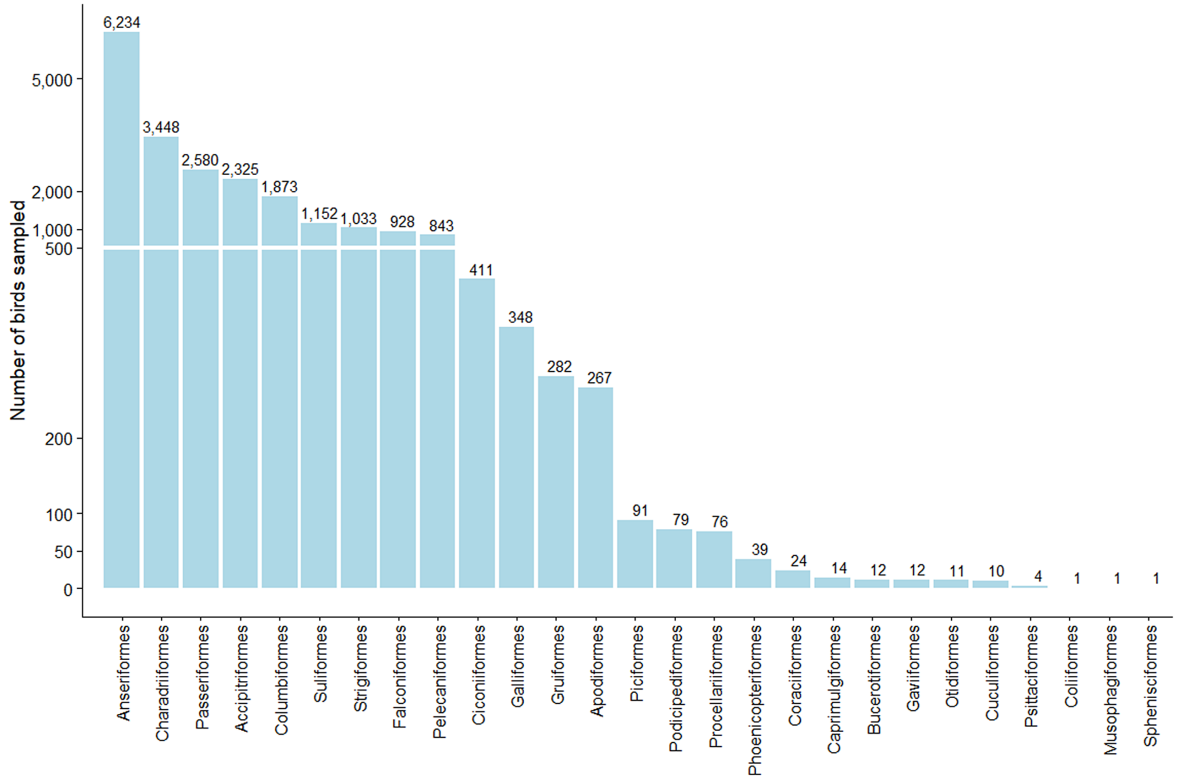


**FIGURE 24** Total numbers of wild birds of the different orders, sampled by passive surveillance in 2022 ($n = 22{,}099$). The *y*-axis is presented on a non-linear scale to improve visibility.

The species diversity sampled per order varied with the majority (approximately 60%) of the different species sampled by passive surveillance belonging to the orders Passeriformes ($n = 81$), Charadriiformes ($n = 55$), Accipitriformes ($n = 26$) and Anseriformes ($n = 23$). In Figure 25, the 40 species (out of 346 fully identified species) with the highest number of wild birds sampled in 2022 are shown.

The three most sampled species (by passive surveillance) were *Cygnus olor* (mute swan), *Anas platyrhynchos* (mallard) and *Buteo buteo* (common buzzard) in accordance with the 2021 results, albeit in a different order. The fourth most sampled species in 2022 was *Larus argentatus* (European herring gull). All English common names for the species shown in Figure 25 are listed in Table E.1 in Appendix E.

Forty-seven out of the 50 target species recommended by EFSA for HPAI surveillance are included in the 346 species reported (Table F.1 in Appendix F). A total of 36.6% ($n = 8086$) and 41.1% ($n = 4127$) of the wild birds sampled by passive and active surveillance belonged, respectively, to these target species.

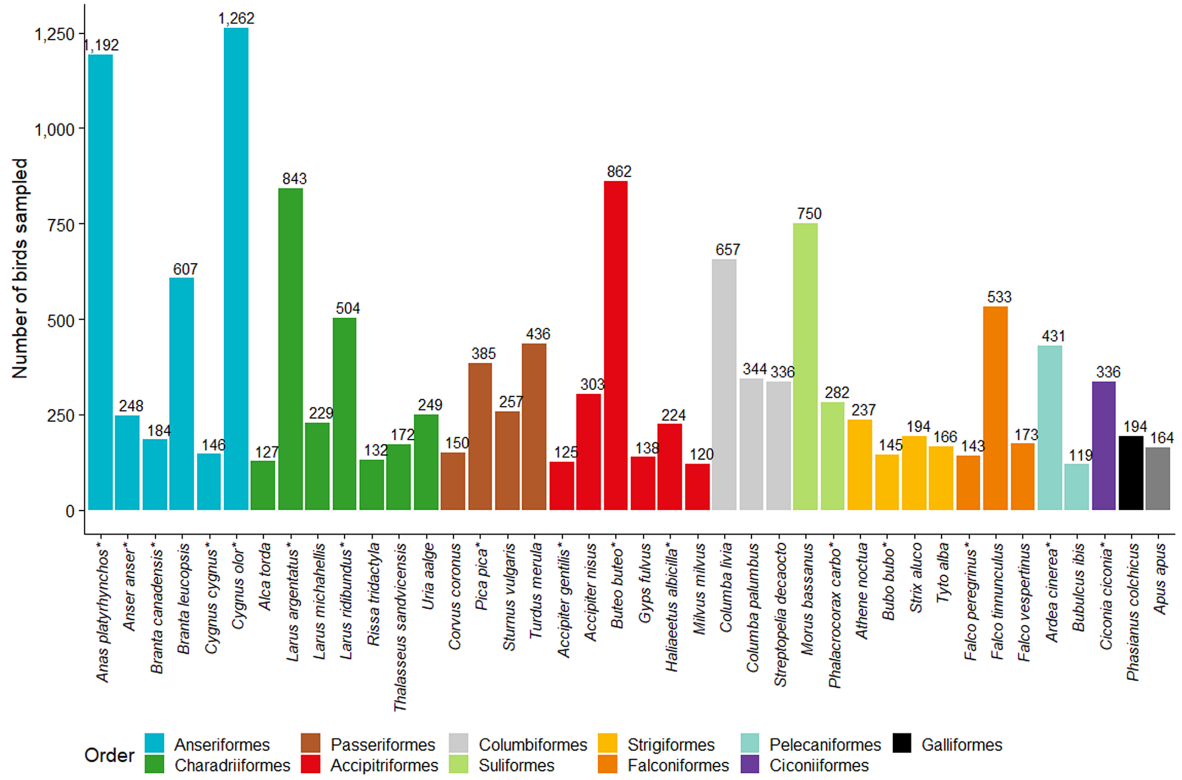


**FIGURE 25** Total numbers of wild birds sampled for the 40 most sampled wild bird species reported by passive surveillance in 2022 (14,099 wild birds out of 18,502 fully identified birds). The bar colours refer to the bird orders. The asterisks indicate the wild bird species belonging to the 50 target species recommended by EFSA for HPAI surveillance. English common names for the species shown are provided in Table E.1 in Appendix E.

## 3.2.2 | Avian influenza in wild birds

### 3.2.2.1 | *Detection of avian influenza virus in samples*

Combining both active and passive surveillance, a total of 5147 (16%) wild birds, out of the 32,143 sampled by RCs, tested positive for AIVs (Table 2). This proportion increased by 60% compared to 2021 (9.9%), which was already slightly higher than in 2020 (8.6%) and was twice as high as in 2019 (4.7%). This steep increase reflected the high infection pressure present in 2022 in wild birds and described in EFSA reports. Of the 5147 AIV-positive wild birds, 4163 were infected with HPAIVs and 984 with LPAIVs.[7]

In 2022 and 2021, the most of AIV-positive wild birds were found by passive surveillance (87% in 2021 and 89% in 2022). Most of them were found dead (4374 birds tested AIV-positive, including 3918 positives for HPAIVs). The proportions of AIV-positive wild birds in active and passive surveillance were 5% and 21%, respectively, indicating higher mortality involved.

**TABLE 2** Test results for wild birds sampled by passive (no background colour) and active (light grey background) surveillance by RCs in 2022, presented by wild bird status. All VI-positive birds in the column 'Positive by VI' had previously tested positive by PCR.

| | Wild bird status | | No. of AIV-positive wild birds | | | |
|---|---|---|---|---|---|---|
| | Bird status | No. of wild birds sampled | Positive by PCR or VI | Positive by VI | HPAIV | LPAIV |
| Active | Hunted with clinical signs | 66 | 14 | 1 | 13 | 1 |
| | Hunted without clinical signs | 2459 | 208 | 35 | 29 | 179 |
| | Alive without clinical signs | 7519 | 330 | 11 | 52 | 278 |
| | Subtotal | 10,044 | 552 | 47 | 94 | 458 |
| Passive | Found dead | 19,527 | 4374 | 78 | 3918 | 456 |
| | Alive with clinical signs | 2572 | 221 | 10 | 151 | 70 |
| | Subtotal | 22,099 | 4595 | 88 | 4069 | 526 |
| **Total** | | **32,143** | **5147** | **135** | **4163** | **984** |

Wild bird sampling results were reported by all countries with location coordinates. Figure 26 shows the geographical distribution of surveillance activities in wild birds conducted by RCs in 2022. Data are aggregated at NUTS3 level. Most of

[7]For some AI-positive birds, one or more samples tested positive for HPAI virus while virus pathogenicity results were not available for one or more of the other positive samples. These birds are considered as HPAI-positive in the present report.

the RCs' territories are covered by surveillance activities with stronger efforts in Belgium, the Netherlands and Germany along the North Sea. Some areas were not sampled on the eastern border of Europe.

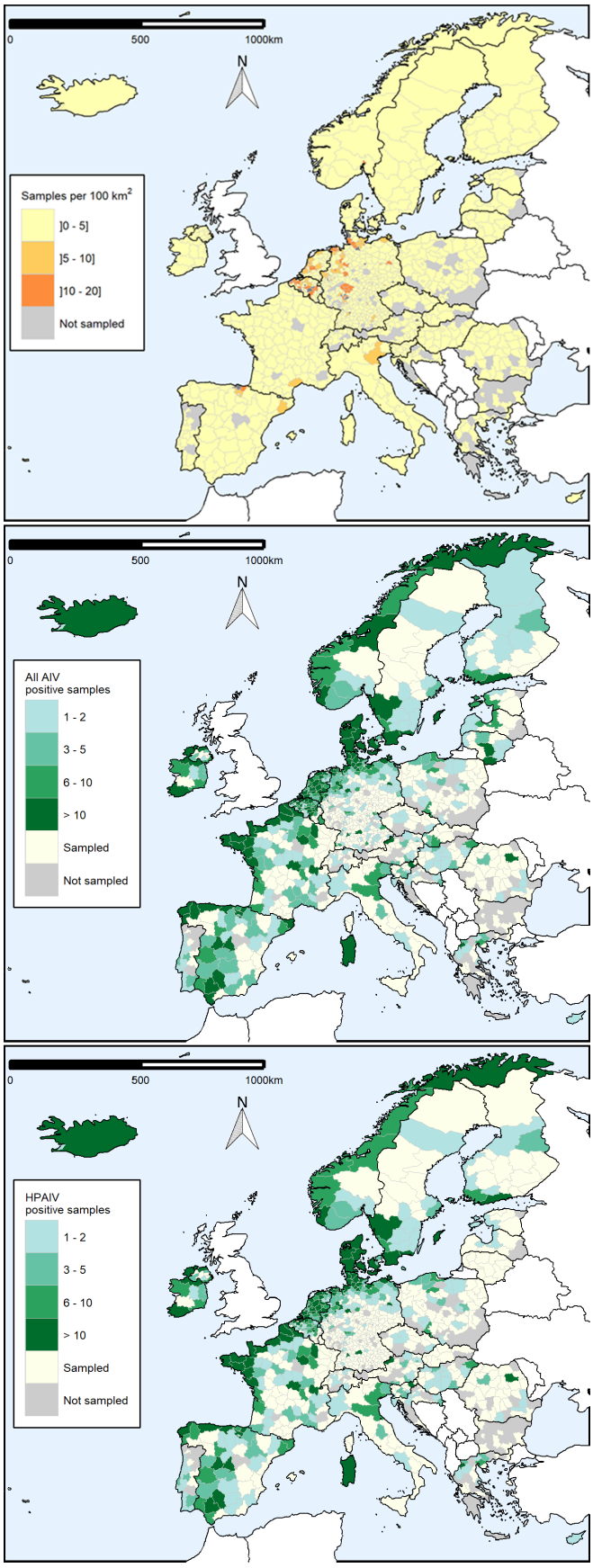


**FIGURE 26** Sampling density, expressed as the numbers of wild birds sampled per 100 km$^2$ (upper map), and geographical distribution of all AIV-positive wild birds (middle map) and HPAIV-positive wild birds (lower map) by administrative unit. Non-reporting countries are shown in white (In accordance 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.).

3.2.2.2 | *Highly pathogenic avian influenza in wild birds*

3.2.2.2.1 | *HPAI results by neuraminidase type*. A total of 4163 wild birds in 26 RCs tested positive for HPAIV in 2022, greater than in 2021 ($n = 2314$), 2020 ($n = 878$) and 2019 ($n = 1$). All but one A(H7N7) positive PE in Italy were classified as belonging to the A(H5) subtype, and almost all of them were identified as influenza A(H5N1) virus (95%). However, in 2021 the main identified A(H5) subtype was influenza A(H5N8) virus (57%), which highlights the dominance of influenza A(H5N1) subtypes in Europe in 2022. Figure 27 summarises the N subtypes identified for these samples.

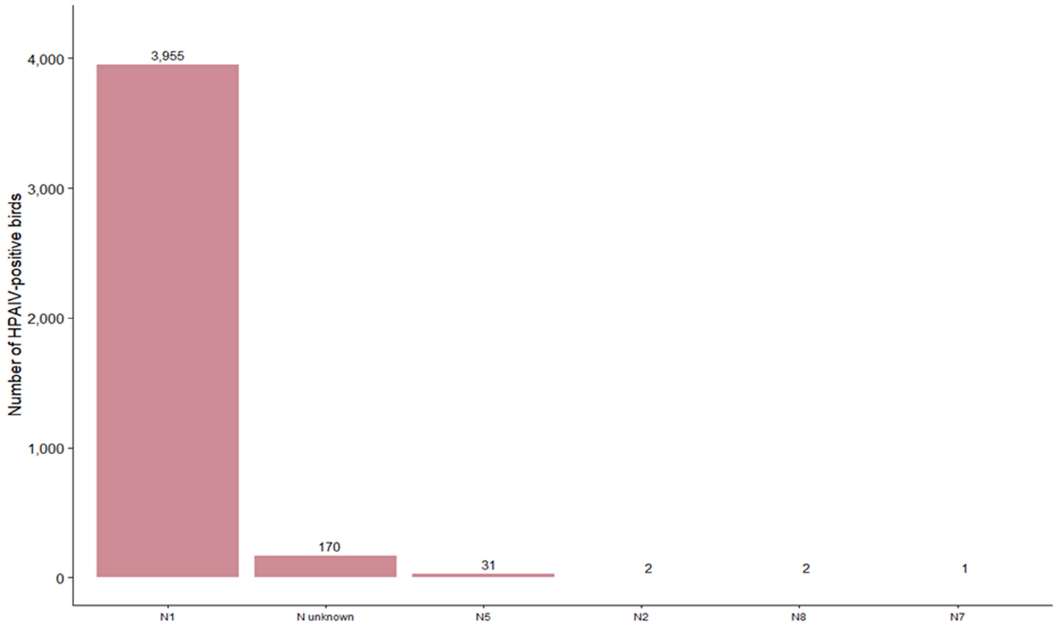


**FIGURE 27** AIV neuraminidase (N) subtypes identified for HPAIV-positive wild birds (all HPAIV were classified as the A(H5) subtype except for one A(H7N7)). Values are provided above bars. There were no wild birds with more than one N subtype identified.

3.2.2.2.2 | *Highly pathogenic avian influenza results by species*. A total of 113 species, wild birds from 18 genera of unknown species, and wild birds from 4 families of unknown species were positive for HPAIVs. These HPAIV-infected wild birds belonged to at least 17 orders, as shown in Figures 28, 29. These two figures show data from passive and active surveillance combined. The same data are presented separately by type of surveillance in Appendices H and I: Figures H.1, H.2 (passive surveillance), and Figures I.1, I.2 (active surveillance).

Half of the HPAIV-positive wild birds belonged to the target species for HPAI surveillance ($n = 2032$, 49%). In particular, the species with the highest number of HPAIV-positive samples identified by passive and active surveillance was *L. argentatus* (European herring gull, $n = 448$) (Figure 28). The following species with the highest numbers of HPAIV-infected wild birds were *Morus bassanus* (northern gannet, $n = 411$) and *B. leucopsis* (barnacle goose, $n = 399$), which are both not listed in the target list. This is the first time that so many wild sea birds breeding in colonies are reported as A(H5N1)-positive. In 2021, the two main species were a waterfowl – *C. olor* (mute swan) and a raptor – *B. buteo* (Eurasian buzzard), despite being part of the three most sampled species both in 2021 and 2022. This highlights a strong shift in the A(H5N1) subtype's ecology in Europe during 2022.

The percentage of HPAIV-positive wild birds by species shown in Figure 29 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 genus level *Uria* spp. was sampled and tested positive, yielding a percentage of 100% for this respective genus.

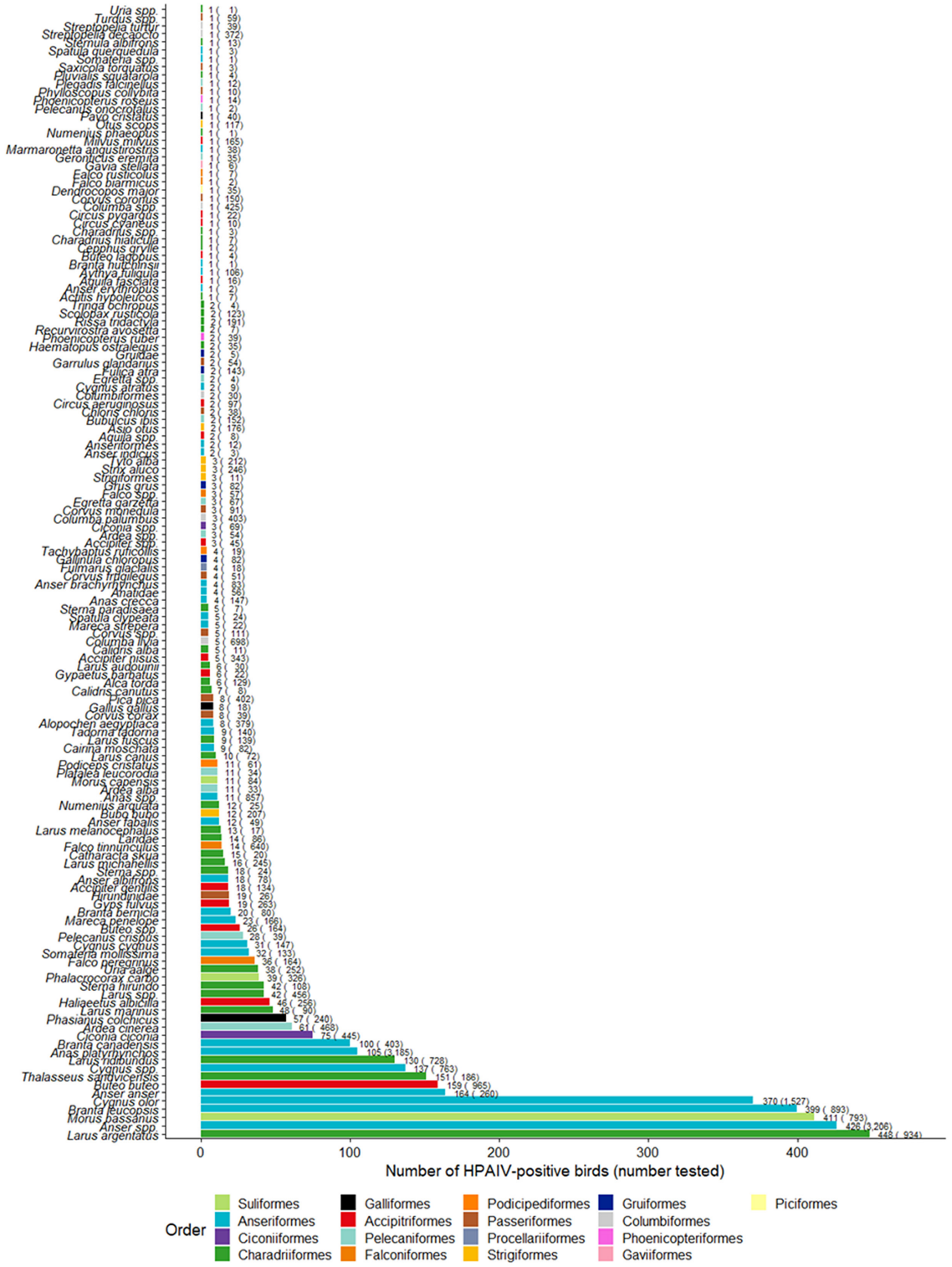


**FIGURE 28** Number of HPAIV-positive wild birds detected by both passive and active surveillance, for species with at least one HPAIV-positive sample. The numbers of wild birds tested are indicated in brackets. Bars are ordered by increasing numbers of positive wild birds and colour-coded to identify the order the species belong to. English common names are provided in Table E.1 in Appendix E. Results discriminated by passive or active surveillance are respectively available in Figure H.1 in Appendix H and in Figure I.1 in Appendix I.

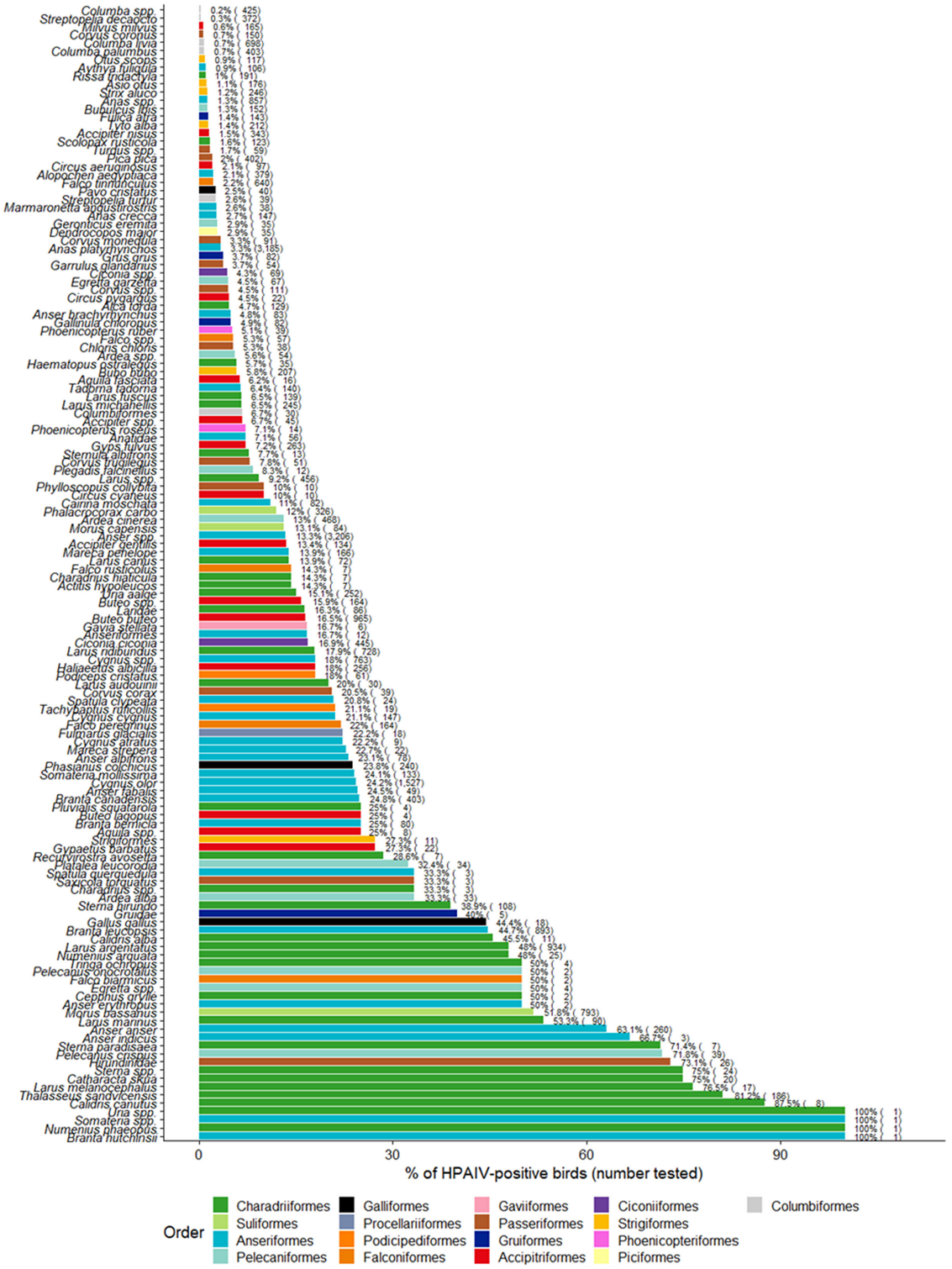


**FIGURE 29** Proportion of HPAIV-positive (all types) wild birds detected among wild birds tested by both passive and active surveillance, for species with at least one HPAIV-positive sample. The numbers of wild birds tested are indicated in brackets. Bars are ordered by increasing proportions of HPAIV-positives wild birds and colour-coded to identify the order the species belong to. English common names are provided in Table E.1 in Appendix E. Results discriminated per passive or active surveillance are respectively available in Figure H.2 in Appendix H and in Figure I.2 in Appendix I.

3.2.2.2.3 | *HPAI 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 the United Kingdom (Northern Ireland) (55.9% of samples), Denmark (47.7% of samples), Greece (46.9% of samples), the Netherlands (46.1%) and Ireland (33.7%).

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

| | Passive surveillance | | Active surveillance | |
|---|---|---|---|---|
| **Country** | **No. of wild birds** | **No. of HPAIV-positive wild birds (%)** | **No. of wild birds** | **No. of HPAIV-positive wild birds (%)** |
| Austria | 338 | 35 (10.4%) | 0 | – |
| Belgium | 944 | 268 (28.4%) | 1499 | 25 (1.7%) |
| Bulgaria | 54 | 0 (0%) | 4 | 0 (0%) |
| Croatia | 70 | 10 (14.3%) | 0 | – |
| Cyprus | 183 | 1 (0.5%) | 14 | 0 (0%) |
| Czechia | 51 | 2 (3.9%) | 0 | – |
| Denmark | 432 | 206 (47.7%) | 0 | – |
| Estonia | 62 | 2 (3.2%) | 44 | 0 (0%) |
| Finland | 360 | 51 (14.2%) | 0 | – |
| France | 3098 | 809 (26.1%) | 3 | 1 (33.3%) |
| Germany | 4600 | 1065 (23.2%) | 5336 | 64 (1.2%) |
| Greece | 64 | 30 (46.9%) | 10 | 0 (0%) |
| Hungary | 639 | 26 (4.1%) | 0 | – |
| Iceland | 159 | 45 (28.3%) | 0 | – |
| Ireland | 202 | 68 (33.7%) | 0 | – |
| Italy | 3652 | 38 (1%) | 0 | – |
| Latvia | 57 | 2 (3.5%) | 0 | – |
| Lithuania | 156 | 0 (0%) | 0 | – |
| Luxembourg | 62 | 0 (0%) | 0 | – |
| Malta | 47 | 0 (0%) | 39 | 0 (0%) |
| Norway | 491 | 105 (21.4%) | 533 | 0 (0%) |
| Poland | 263 | 63 (24%) | 390 | 0 (0%) |
| Portugal | 182 | 18 (9.9%) | 40 | 0 (0%) |
| Romania | 224 | 39 (17.4%) | 7 | 0 (0%) |
| Slovakia | 31 | 0 (0%) | 0 | – |
| Slovenia | 308 | 49 (15.9%) | 0 | – |
| Spain | 2995 | 254 (8.5%) | 2125 | 4 (0.2%) |
| Sweden | 610 | 89 (14.6%) | 0 | – |
| Switzerland | 114 | 7 (6.1%) | 0 | – |
| The Netherlands | 1540 | 710 (46.1%) | 0 | – |
| United Kingdom (Northern Ireland) | 111 | 62 (55.9%) | 0 | – |

[a]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.

3.2.2.2.4 | *HPAI results in time*. Figure 30 displays the timeline of HPAIV detection in wild birds in RCs in 2022, for passive and active surveillance separately (blue and red colours, respectively). As part of the continuing HPAI A(H5Nx) epidemic since late 2020, HPAIV-positive wild birds were detected in the first week of 2022. Unlike previous years, the detection remained quite high throughout the year, with at least 7% of the weekly sampled wild birds being HPAIV-positive. Despite constant fluctuations in the proportion of HPAIV-positive wild birds in passive surveillance, two peaks can be observed: one in the first week, when 49.5% of the sampled wild birds were HPAIV-positive, and the other one in the 24th week when 43.0% of the sampled wild birds were HPAIV-positive.

The continuous presence of the HPAIV-positive birds all year long in 2022 is very different from the pattern observed previously. In the last 2 years, the epidemic season usually starts in September and lasts until the end of spring of the following year. Throughout the year, the proportion of wild bird orders among the weekly HPAIV-positive wild birds varied. Between weeks 1–17 and 39–52 the HPAIV-positive wild birds most frequently belong to the Anseriformes order, while between weeks 18 and 38 (summer period), the HPAIV-positive wild birds mainly belong to the Charadriiformes and Suliformes orders. This coincides with the mass mortality events observed in Europe in wild sea birds breeding in colonies (EFSA, ECDC, EURL et al., 2022a, 2022b, 2023a, 2023b).

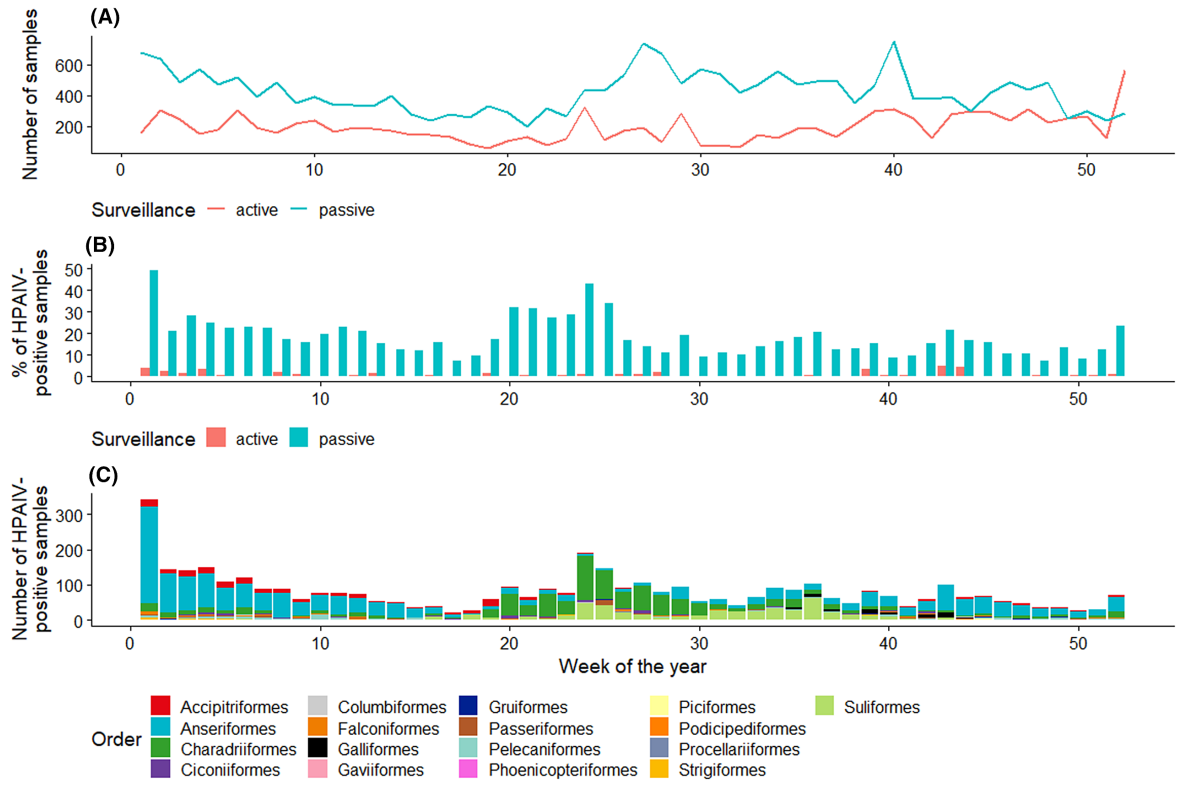


**FIGURE 30** (A) Weekly number of wild birds sampled by both, passive and active surveillance, (B) weekly percentage of HPAIV-positive wild birds found, and (C) weekly number of HPAIV-positive wild birds by taxonomic order.

### 3.2.2.3 | *Low pathogenic avian influenza in wild birds*

Among the 984 wild birds that tested positive for AIVs other than HPAIVs, 127 wild birds were infected with LPAIVs, while no virus pathogenicity results were available for the remaining 857 wild birds. Out of the 857 wild birds for which information on the virus pathogenicity was not available, there were 221 wild birds positive for A (H5) viruses. For the remainder of this section, 'LPAIV-positive' wild birds include all positive wild birds which were not positive for HPAIVs ($n = 984$). This is consistent with previous reports.

LPAIV-positive wild birds were reported by 20 RCs and mainly from passive surveillance activities (53.5%). Among all LPAIV-positive wild birds ($n = 984$), 247 were classified as A(H5) and 13 as A(H7) viruses. The majority of the LPAIVs detected were reported as non-A(H5/H7) subtype AIVs ($n = 660$), without further information on the subtypes provided. Figure 31 summarises all the identified and reported LPAI subtypes.

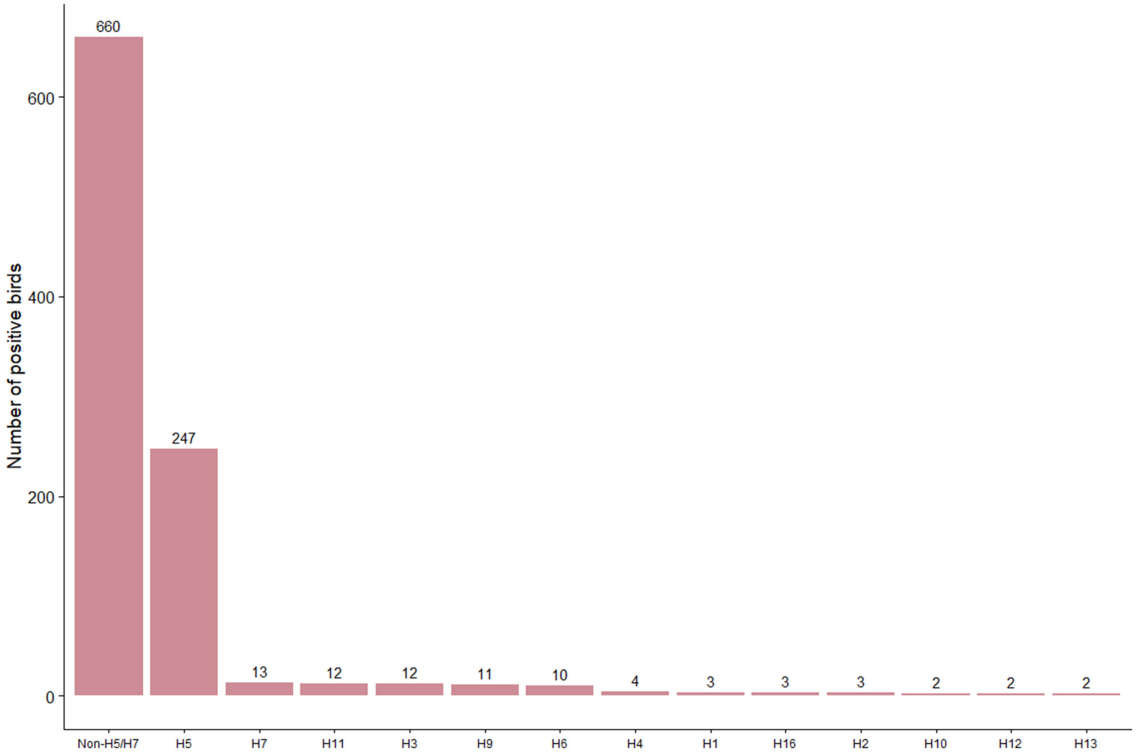


**FIGURE 31** AIV haemagglutinin (H) subtypes identified for LPAIV-positive wild birds. Values are provided above bars. Wild birds for which positive samples could not all be typed (for example, one sample was characterised as belonging to A(H5) and another sample from the same wild bird for which the H subtype was unknown) are classified under the available H type (in this example, H5). There were no wild birds for which more than one H subtype was identified.

As shown in Figure 32, most LPAIV-positive wild birds were found in week 52 ($n = 128$) for active surveillance and in week 26 ($n = 32$) for passive surveillance. However, as for HPAIV-positive wild birds and unlike the previous years, no distinct seasonal pattern can be observed. As in the previous year, most LPAIV-positive wild birds belonged to the order Anseriformes (Figure 32C), which is the most sampled order by both active and passive surveillance.

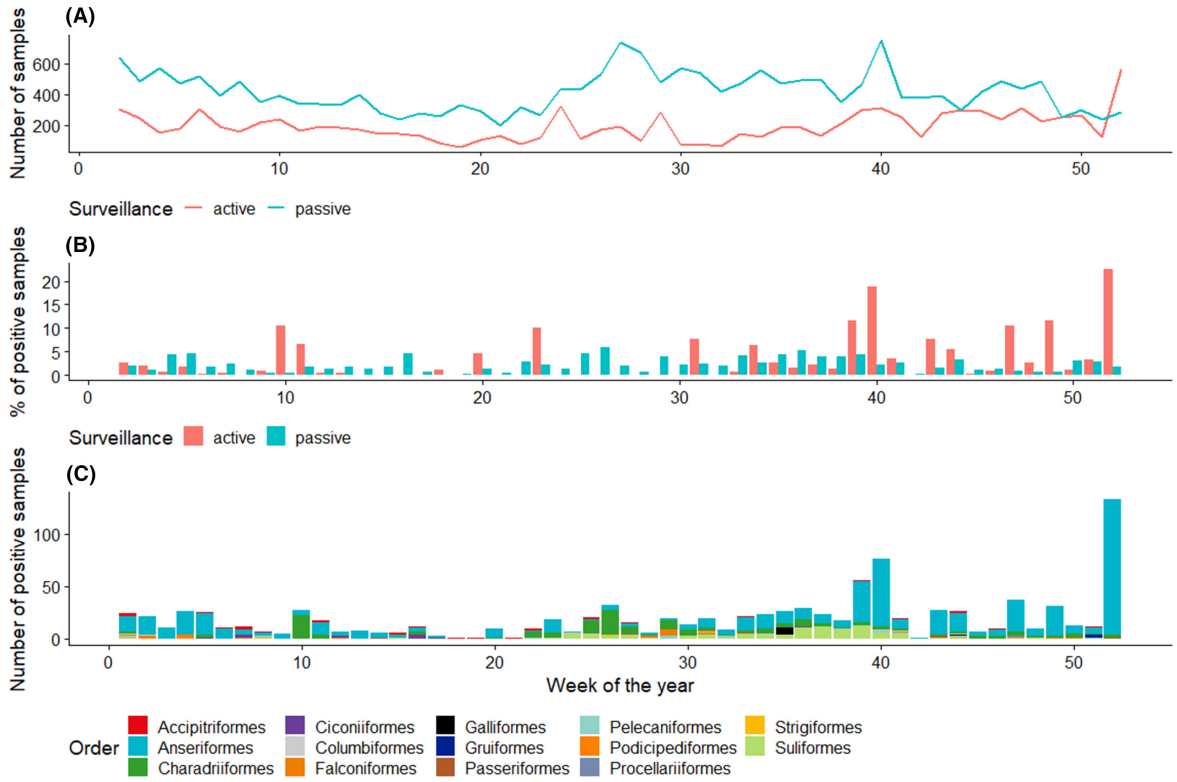


**FIGURE 32** (A) Weekly number of wild birds sampled by both, passive and active surveillance, (B) weekly percentage of LPAIV-positive wild birds found, and (C) weekly number of LPAIV-positive wild birds by taxonomic order.

### 3.2.3 | Abundance and distribution of wild birds in Europe

Voluntary contribution data on the abundance and distribution of wild bird species have been made available to EFSA by the EBP. EBP[8] 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 (about 50 million wild bird records from about 100,000 voluntary contributors annually). Information on the distribution of the 50 species included in the target list of wild bird species (Table F.1 in Appendix F) is now being submitted to EFSA annually, aggregated at NUTS3 and monthly levels. 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 G.1 (Appendix G) 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).[9] This figure shows that the countries with the highest number of regions with densities of observations of wild birds higher than 1000 observations per km (all species, i.e. an indirect measure of the observation effort) are Denmark, Luxembourg, the Netherlands, Switzerland, Belgium and the United Kingdom (Northern Ireland). The density was lower in Norway, Romania, Slovenia, Slovakia, Cyprus, Estonia, Croatia, Hungary, Ireland and Latvia. No data were provided by Lithuania and Malta. Within countries, the variability between NUTS3 regions was high. During the course of the year, wild bird observations were reported at least once for 37,647 NUTS3 regions in total in the countries for which EBP data were available. Wild birds from the EFSA target list were reported in all these NUTS3 regions (Appendix G, Figure G.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 (a 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[10] at the monthly level: 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 G.2, G.3 (Appendix G) 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 F.1 in Appendix F). A total of 42% 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 fifth in terms of sampling but were not reported in the available EBP data.

Last, there were also some discrepancies between the wild birds reported as observed and found dead by passive surveillance programmes. There were 4487 records of dead bird samples from EFSA target species for a given species, NUTS3 and month. Among these, 601 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

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 must be avoided. Similarly, survey results between virology and serology reflect different information and should not be compared to draw overall conclusions on the pattern of the disease.

A targeted (non-representative) sampling approach helps to increase the efficiency of detection of AIVs, but prevents valid assessments of measures of disease occurrence, differences between locations, categories or species, or trends over time. Comparisons of positivity rates between different locations, categories, species or time periods are valid for the specific observations (surveillance samples) for a specific survey only and cannot be extrapolated to the source populations. Positivity rates are not only influenced by disease and surveillance assay but also by the efficiency of the risk-based

[8] https://eurobirdportal.org/ebp/en/#home/HIRRUS/r52weeks/CUCCAN/r52weeks/

[9] https://doi.org/10.5281/zenodo.10201041

[10] https://doi.org/10.5281/zenodo.10201041

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

2022 is the first year where surveillance of AIV is fully framed in the context of the Commission Delegated Regulation (EU) 2020/689. The main change in the new framework is the introduction of virological surveys for ducks, geese and poultry belonging to the species of Anseriformes for supplies of game or quails described as animals that generally do not show any clinical signs. The surveillance activities remain based on risk assessment which will differ highly between countries. Hence compared to previous years, the surveillance strategies across countries are even more heterogeneous. However, according to the sampling reported by the different countries, three main survey strategies can be observed:

- **mainly based on serological surveys**, such as the Netherlands, Romania, Belgium, Germany, Poland, Hungary, Ireland, Bulgaria, Austria, Croatia, Slovenia, Greece, Switzerland, Cyprus, Latvia, Lithuania, Iceland and Malta. Out of those, eight RCs did not sample any species that generally do not show any clinical signs (Romania, Bulgaria, Croatia, Greece, Finland, Switzerland, Lithuania and Malta).
- **mainly based on virological surveys**, such as Estonia and United Kingdom (Northern Ireland). For the purposes of the annual report, France decided to use only the analytical surveillance data linked to the lifting of the restricted zones, given that these zones were located in the parts of the territory most at risk, with the highest poultry densities and the areas most affected by the crisis.
- **based on both virological and serological surveys,** depending on poultry categories, with virological methods preferred when the PEs hold species that generally do not show clinical signs (such as Italy, Spain, Czechia, Portugal, Finland, Sweden, Denmark, Norway and Luxembourg).

It is clear, therefore, that when describing the results from serological or virological surveys, the weight of each country will not only vary according to their specific context but also according to their risk-based sampling strategies.

An increasing trend in the number of PEs sampled for serology was observed between 2017 and 2019 until a plateau of around 24,000 PEs sampled per year was reached for the last 3 years. However, in 2022, this trend stopped as the number of sampled PEs dropped to 22,171. This may be linked to the modification in the sampling strategies occurring in different countries. Among the surveyed PEs, 15 PEs were seropositive for A (H5) viruses and 74 PEs were positive to A (H5) virological assay. For the first time since 2008, no influenza A(H7) virus was characterised in sampled PEs. This is similar to wild birds where only one HPAIV-positive detection was characterised as A(H7) viruses.

In 2022, A(H5)-positive PEs from 12 different poultry categories were detected by virological surveys consistently throughout the year for a total number of 74 PEs recording at least one detection. The monthly sampling strategies are too heterogeneous to correlate any results to the large HPAI A(H5Nx) epidemic occurring in Europe since October 2020. However, according to the virological samples, most PEs were positive for HPAI A(H5N1) viruses as identified in the epidemic's outbreak.

This epidemic recorded 1385 and 2747 outbreaks during 2020–2021 and 2021–2022 epidemic seasons in domestic birds, respectively (EFSA, ECDC, EURL et al., 2023a) and the outbreaks were mainly identified through early detection surveillance. It has been the largest HPAI A(H5Nx) epidemic recorded in the EU since 2016–2017. The outbreaks in Europe are to be linked with a wider epidemic of A(H5N1) viruses of clade 2.3.4.4b (EFSA, ECDC, EURL et al., 2022b), which was first described in late 2016 at the Qinghai Lake in China and the Lake Uvs-Nuur in Russia (Lewis et al., 2021; Verhagen et al., 2021). Since then, it has spread to Europe and Africa. These A(H5N1) viruses of clade 2.3.4.4b have also been introduced by the Atlantic flyway in North America in 2021 and later spread to Central and South America in 2022 (Caliendo et al., 2022).

The serological test results by species categories in 2022 were similar to previous years although there was no detection of seropositive PEs from breeding ducks. The highest risk of circulation of A(H5/H7) viruses remains in aquatic birds (game birds, breeding geese and ducks), while gallinaceous birds (in particular chickens and turkeys), despite the more intense sampling activity, recorded a low positivity rate overall. While backyard establishments and conventional laying hens accounted for the largest numbers tested, only two A(H5)-seropositive PEs were identified in each category respectively.

PEs with positive serological tests can also be tested by PCR. Concomitant PCR results were available for all 15 A(H5)-seropositive PEs, unlike previous years. Only three of these PEs also tested positive by PCR with two of them characterised as the HPAI A(H5N1) subtype in laying hens and the other as a LPAI A(H5N3) virus in waterfowl game birds.

The Commission Delegated Regulation (EU) 2020/689,[11] requires MSs to carry out complementary risk-based surveillance aiming to detect clusters of establishments (in time and geographical proximity) infected with LPAIVs as well as surveillance of PEs with a high-risk of lateral transmission. The surveillance of LPAIVs in high-density poultry areas is implemented not only because of their potential capacity to mutate to HPAIV but also to improve knowledge of the

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

zoonotic risk of AIVs. However, the number of seropositive PEs dropped compared to the previous surveillance level. This could either reflect an actual drop in the circulation of LPAIV or low sensitivity of the risk-based surveillance strategy.

Active surveillance provides useful insights into the circulation of AIVs in PEs, in particular for LPAIVs and poultry species or categories which are mostly sub clinically affected. However, the sensitivity of this approach remains limited, as it does not provide high coverage in terms of population and time. Therefore, different surveillance approaches should be considered when interpreting the present results. 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 as well as the RCs' sampling scheme would improve interpretation of the AI surveillance results at the European level. Starting from 2024, with the adoption of the SIGMA approach for the collection of Avian Influenza data, the RCs will be given the opportunity to collect domestic animal population data, giving EFSA the possibility of performing more sophisticated analysis and try to extrapolate more informative information for the monitoring and the control of the disease.

## 4.2 | Wild birds

The number of wild birds tested by passive surveillance by all 31 RCs in 2022 ($n = 22{,}099$) was substantially higher than in the past 3 years. Thirteen countries also reported 10,044 wild birds sampled under active surveillance activities.

While 2314 wild birds sampled tested positive for HPAIVs in 2021, the number of wild birds that tested positive for HPAIVs was 16% higher in 2022. Out of the 5147 HPAIV-positive wild birds, 4374 were found dead and sampled by passive surveillance programmes. These values continue to support the importance of this surveillance approach for AI in wild bird species. Unlike previous years, both sampling and HPAIV-positive test results did not mainly occur in the first and fourth quarter of 2022 but were balanced throughout the year. In the summer of 2021, there were only a few detections of HPAIV-positive wild birds, while in 2022 a peak in the number of HPAIV-positive samples could be observed. This is evidence of the shift in the epidemiology of A(H5N1) viruses of clade 2.3.4.4b circulating in wild birds in Europe. Furthermore, previous observations had already identified the potential for these viruses to be enzootic in Europe. Researchers made the hypothesis that a sublineage of the A(H5N1) viruses of clade 2.3.4.4b could have been maintained in northern Europe throughout the summer 2021 (Pohlmann et al., 2022). Concurrently, in Italy during winter 2020–2021, a high prevalence of HPAI A(H5) viruses was observed in hunted birds in geographical areas where no dead birds were detected (Gobbo et al., 2021).

Furthermore, while 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 similar (53% and 49%, respectively in 2021 and 2022), the two species with the highest number of HPAIV-positive samples in 2022 were not waterfowls but *L. argentatus* (European herring gull, $n = 448$) and *Morus bassanus* (northern gannet, $n = 411$). This echoes the multiple mass mortality events reported in wild sea birds breeding in colonies across Europe in 2022 (EFSA, ECDC, EURL et al., 2022a, 2022b, 2023a, 2023b). The A(H5N1) viruses of clade 2.3.4.4b characterised in those species were mainly a reassortment of a gull-adapted influenza A(H13) subtype, which is an example of the multiple genotypes circulating in Europe (EFSA, ECDC, EURL et al., 2022b). This subtype could also be linked to a mass mortality event that occurred in *Stercorarius Skua* (great skuas) on the United Kingdom offshore island in the summer of 2021 (Banyard et al., 2022).

Hence in 2022, multiple elements indicate a shift of interaction between the A(H5N1) viruses of clade 2.3.4.4b and the different species with examples of virus subtype maintenance in some and mass mortality in others. The present results suggest that the list should be adjusted with recent knowledge about the species of interest depending on their likelihood of dying when infected with HPAIVs. An updated list of species will be available by the end of 2023.

In 2022, 84% of the sampled wild birds were identified at the species level, while in 2021 this was only half. This highlights the strong efforts undergone by all RCs to improve species identification in 2022.

Summary data provided by the EBP project are presented (Appendix G) to describe the number of wild bird observations reported by voluntary contributors in 2022. These data may provide some context regarding the performance of passive surveillance of AI in wild birds in the EU. The density of wild bird observations is the product of two factors:

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

As a result, areas with a 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 these limitations, 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[12]), 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 are currently supported by the Animal Health Law, 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. Commission Implementing Regulation (EU) 2020/2022[13] lays down the procedures related to Union notification and Union reporting and sampling and laboratory testing method principles.

## 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, 2022).

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 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 should be interpreted as the number of sampling events taking place in a RC for each of the reported poultry categories. Throughout the report, the term numbers 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 2018, 2019 and 2020 reports, the updated EFSA list of target species (Table F.1 in Appendix F) 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 is 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.[14]

Eurostat reference shapefiles were used to create the maps: 'Countries 2020' (version 3/6/2019) and 'NUTS 2021' (version 10/3/2023). These versions were used to match the units reported in the surveillance data for 2022. Maps plotting the geographical distribution of the sampling events and the location of positive results were aggregated at NUTS2 level for both poultry and wild birds in the present report. However, maps at NUTS3 level are also provided as high-quality images on the EFSA website, for countries which provided data at NUTS3 level. To summarise sampling activities, the intensity of sampling, calculated as the number of samples taken within a NUTS2 region per 100 $km^2$, was displayed, given that the total number of 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 HPAI virus detections in wild birds, from data reported to the Animal Disease Information System (ADIS), the World Animal Health Information System (WAHIS) or individual national surveillance databases.

### ABBREVIATIONS

| | |
|---|---|
| AIV | avian influenza |
| AIV | avian influenza A virus |
| H | haemagglutinin |
| HPAI | high pathogenic avian influenza |
| HPAIV | highly pathogenic avian influenza viruses |

[12] https://doi.org/10.5281/zenodo.10201041

[13] 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.

[14] 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).

| | |
|---|---|
| LPAI | low pathogenic avian influenza |
| LPAIV | low pathogenic avian influenza viruses |
| MS | Member State |
| N | neuraminidase |
| NUTS | Nomenclature of Territorial Units for Statistics |
| PE | Poultry Establishment |
| RC | Reporting Country |

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## CONFLICT OF INTEREST

If you wish to access the declaration of interests of any expert contributing to an EFSA scientific assessment, please contact interestmanagement@efsa.europa.eu.

## REQUESTOR

European Commission

## QUESTION NUMBER

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## MAP DISCLAIMER

The designations employed and the presentation of material on any maps included in this scientific output do not imply the expression of any opinion whatsoever on the part of the European Food Safety Authority concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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# APPENDIX A

## Comparison of detailed poultry establishment categories with previous reporting categories

**TABLE A.1** Total number of PEs sampled and testing positive in 2022, according to the 16 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 for serology | Number of A(H5/H7) seropositive events | Number of sampling events for virology | Number of A(H5/H7) positive events |
|---|---|---|---|---|---|
| Laying hens | Laying hens | 3629 | 33 | 807 | 9 |
| Free-range laying hens | Free-range laying hens | 2796 | 31 | 206 | 0 |
| Broilers (at heightened risks) | Broilers | 1026 | 0 | 905 | 5 |
| | Free-range broilers | 91 | 1 | | |
| Breeding chickens | Breeding chickens | 1981 | 31 | 164 | 31 |
| | Chickens | 21 | 0 | | |
| | Free-range breeding chickens | 2 | 0 | | |
| Breeding turkeys | Breeding turkeys | 94 | 0 | 4 | 0 |
| Fattening turkeys | Fattening turkeys | 1365 | 26 | 134 | 14 |
| | Free-range fattening turkeys | 7 | 0 | | |
| | Free-range turkeys | 1 | 0 | | |
| | Turkeys | 26 | 0 | | |
| Breeding ducks | Breeding ducks | 61 | 3 | 98 | 0 |
| | Ducks | 1 | 0 | 2 | 0 |
| Fattening ducks | Fattening ducks | 412 | 14 | 213 | 0 |
| | Free-range fattening ducks | 32 | 0 | | |
| Breeding geese | Breeding geese | 108 | 5 | 24 | 0 |
| Fattening geese | Fattening geese | 270 | 2 | 10 | 0 |
| | Free-range fattening geese | 52 | 0 | | |
| | Geese | 1 | 0 | | |
| | Free-range geese | | | 1 | 1 |
| Growers | Chickens | 14 | 0 | | |
| | Generic poultry | 1804 | 0 | 4 | 31 |
| | Turkeys | 1 | 0 | | |
| Backyard flocks | Backyard | 3625 | 51 | 330 | 51 |
| Game birds (gallinaceous) | Farmed game birds (Gallinaceous) | 287 | 9 | 93 | 0 |
| | Free-range pheasants | 4 | 0 | | |
| | Guinea-fowl | 4 | 0 | 70 | 0 |
| | Partridges | 8 | 0 | 27 | 0 |
| | Pheasants | 66 | 0 | 5 | 0 |
| | Quails | 56 | 1 | 34 | 0 |
| Game birds (waterfowl) | Farmed game birds (Waterfowl) | 60 | 25 | 20 | 0 |
| | Mallard ducks | 3 | 0 | 48 | 0 |
| Ratites | Free-range ostriches | 13 | 0 | | |
| | Ostriches | 34 | 0 | 2 | 0 |
| | Ratites | 27 | 2 | 5 | 0 |

**TABLE A.1** (Continued)

| Reporting category used in this report | Detailed reporting category | Number of sampling events for serology | Number of A(H5/H7) seropositive events | Number of sampling events for virology | Number of A(H5/H7) positive events |
|---|---|---|---|---|---|
| Others | Chickens | 134 | 4 | 68 | 0 |
| | Ducks | 309 | 0 | 470 | 0 |
| | Free-range chickens | 29 | 0 | | |
| | Geese | 12 | 0 | 4 | 0 |
| | Turkeys | 24 | 0 | 5 | 0 |
| | Free-range ducks | | | 1 | 0 |
| | Other | | | 21 | 0 |

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

| Reporting category used in this report | Detailed reporting category | Poultry species | Purpose of raising | Production methods |
|---|---|---|---|---|
| Backyard flocks | Backyard | 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 |
| | | *Gallus gallus* (chicken) (as animal) | Breeding purpose | Backyard farming – growing |
| | | *Gallus gallus* (chicken) (as animal) | Growers | Backyard farming – growing |
| | | *Gallus gallus* (chicken) (as animal) | Not available | Backyard farming – growing |
| | | Gallus gallus breeding flock (as animals) | Breeding purpose | Backyard farming – growing |
| | | *Gallus gallus* breeding flock (as animals) | Not available | Backyard farming – growing |
| | | *Gallus gallus* broiler (as animal) | Meat production purpose | Backyard farming – growing |
| | | *Gallus gallus* broiler (as animal) | Not available | Backyard farming – growing |
| | | *Gallus gallus* laying hens (as animal) | Breeding purpose | Backyard farming – growing |
| | | *Gallus gallus* 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) | Breeding purpose | 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 |

(Continues)

**TABLE A.2** (Continued)

| Reporting category used in this report | Detailed reporting category | Poultry species | Purpose of raising | Production methods |
|---|---|---|---|---|
| Breeding chickens | Breeding chickens | *Gallus gallus* breeding flock (as animals) | Breeding purpose | Not available |
| | | *Gallus gallus* breeding flock (as animals) | Not available | Not available |
| | Chickens | *Gallus gallus* (chicken) (as animal) | Breeding purpose | Not available |
| | Free-range breeding chickens | *Gallus gallus* breeding flock (as animals) | Not available | Outdoor/free-range growing condition |
| Breeding ducks | Breeding ducks | Duck breeding flock (as animals) | Breeding purpose | Not available |
| | | Duck breeding flock (as animals) | Game purpose | Not available |
| | | Duck breeding flock (as animals) | Not available | Not available |
| | Ducks | Duck (as animal) | Breeding purpose | Not available |
| | | Duck laying hens (as animal) | Breeding purpose | Not available |
| Breeding geese | Breeding geese | Goose breeding flock (as animals) | Breeding purpose | Not available |
| | | Goose breeding flock (as animals) | Not available | Not available |
| | Free-range breeding geese | Goose breeding flock (as animals) | Not available | Outdoor/free-range growing condition |
| | Geese | Goose laying hens (as animal) | Breeding purpose | Not available |
| Breeding turkeys | Breeding turkeys | Turkey breeding flock (as animals) | Breeding purpose | Not available |
| | | Turkey breeding flock (as animals) | Not available | Not available |
| Fattening ducks | Fattening ducks | Duck fattening animal (as animal) | Breeding purpose | Not available |
| | | Duck fattening animal (as animal) | Game purpose | Not available |
| | | Duck fattening animal (as animal) | Meat production purpose | Not available |
| | | Duck fattening animal (as animal) | Not available | Not available |
| | Free-range fattening ducks | Duck fattening animal (as animal) | Not available | Outdoor/free-range growing condition |
| Fattening geese | Fattening geese | Goose fattening animal (as animal) | Meat production purpose | Not available |
| | | Goose fattening animal (as animal) | Not available | Not available |
| | Free-range fattening geese | Goose fattening animal (as animal) | Not available | Outdoor/free-range growing condition |
| | Free-range geese | Goose (as animal) | Not available | Outdoor/free-range growing condition |
| | Geese | Goose (as animal) | Meat production purpose | 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 |
| | Free-range turkeys | Turkey (as animal) | Not available | Outdoor/free-range growing condition |
| | Turkeys | Turkey (as animal) | Meat production purpose | Not available |
| Free-range laying hens | Free-range laying hens | Gallus *gallus* laying hens (as animal) | Breeding purpose | Outdoor/free-range growing condition |
| | | Gallus *gallus* laying hens (as animal) | Not available | Outdoor/free-range growing condition |

**TABLE A.2** (Continued)

| Reporting category used in this report | Detailed reporting category | Poultry species | Purpose of raising | Production methods |
|---|---|---|---|---|
| Game birds (gallinaceous) | Farmed game birds (gallinaceous) | Galliformes (as animal) | Game purpose | Not available |
| | | Galliformes (as animal) | Not available | Not available |
| | | Galliformes (as animal) | Not available | Outdoor/free-range growing condition |
| | | 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 |
| | | Pheasant (as animal) | Not available | 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 |
| | | 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 |
| Game birds (waterfowl) | Ducks | Duck (as animal) | Game purpose | Not available |
| | Farmed game birds (waterfowl) | Anas (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 |

(Continues)

**TABLE A.2** (Continued)

| Reporting category used in this report | Detailed reporting category | Poultry species | Purpose of raising | Production methods |
|---|---|---|---|---|
| Growers | Chickens | *Gallus gallus* (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 |
| Laying hens | Laying hens | Gallus *gallus* laying hens (as animal) | Breeding purpose | Not available |
| | | Gallus *gallus* laying hens (as animal) | Not available | Not available |
| Muscovy ducks | Muscovy ducks | Muscovy duck (as animal) | Not available | Not available |
| Others | Chickens | *Gallus gallus* (chicken) (as animal) | Not available | Not available |
| | Ducks | Duck (as animal) | Meat production purpose | Not available |
| | | Duck (as animal) | Not available | Not available |
| | | Duck laying hens (as animal) | Not available | Not available |
| | Free-range chickens | *Gallus gallus* (chicken) (as animal) | Not available | Outdoor/free-range growing condition |
| | Free-range ducks | Duck (as animal) | Not available | Outdoor/free-range growing condition |
| | Geese | Goose (as animal) | Not available | Not available |
| | | Goose laying hens (as animal) | Not available | Not available |
| | Other | 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 |
| 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 |
| Broilers (heightened risk) | Broilers | *Gallus gallus* broiler (as animal) | Breeding purpose | Not available |
| | | *Gallus gallus* broiler (as animal) | Meat production purpose | Not available |
| | | *Gallus gallus* broiler (as animal) | Not available | Not available |
| | Free-range broilers | *Gallus gallus* broiler (as animal) | Not available | Outdoor/free-range growing condition |

# APPENDIX B

## Serological test results by poultry species

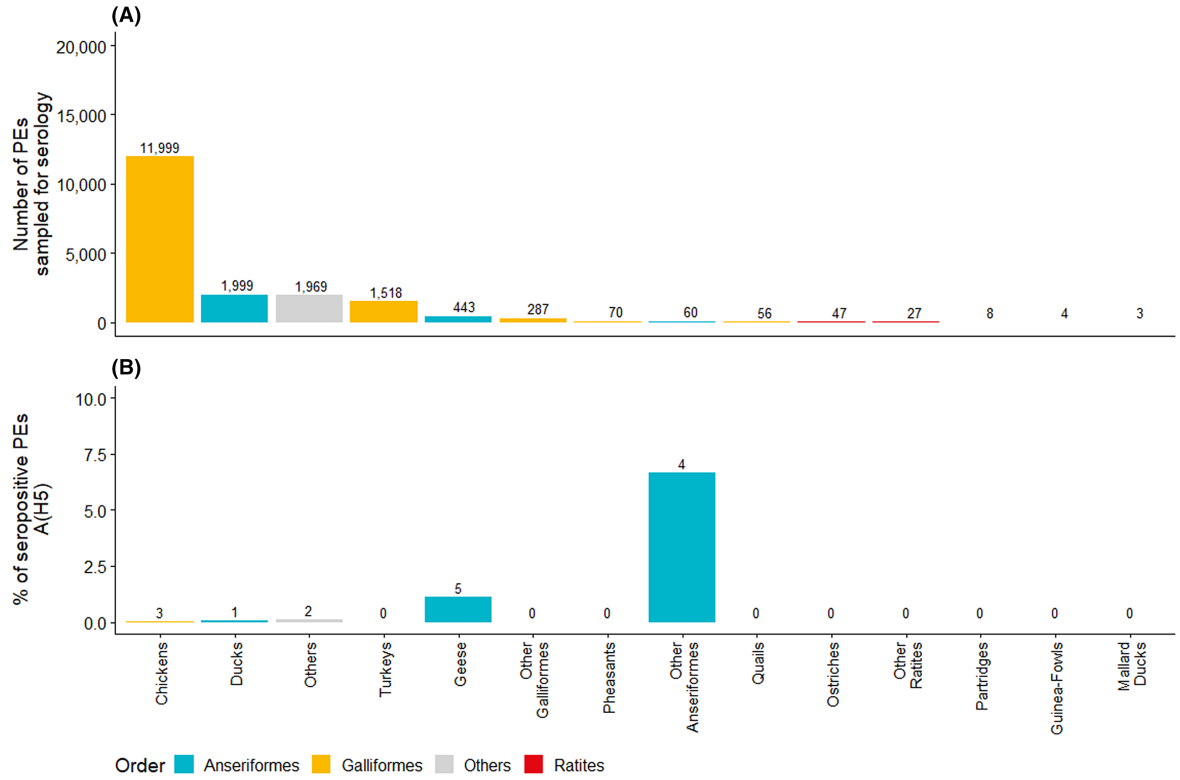


**FIGURE B.1** (A) Number of PEs sampled for serological survey by poultry species, (B) proportion of PEs sampled that tested positive for influenza A(H5) viruses by serology. The numbers above bars indicate the numbers of seropositive PEs. Bars are colour-coded to identify the order the species belong 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

## Virological test results by poultry species

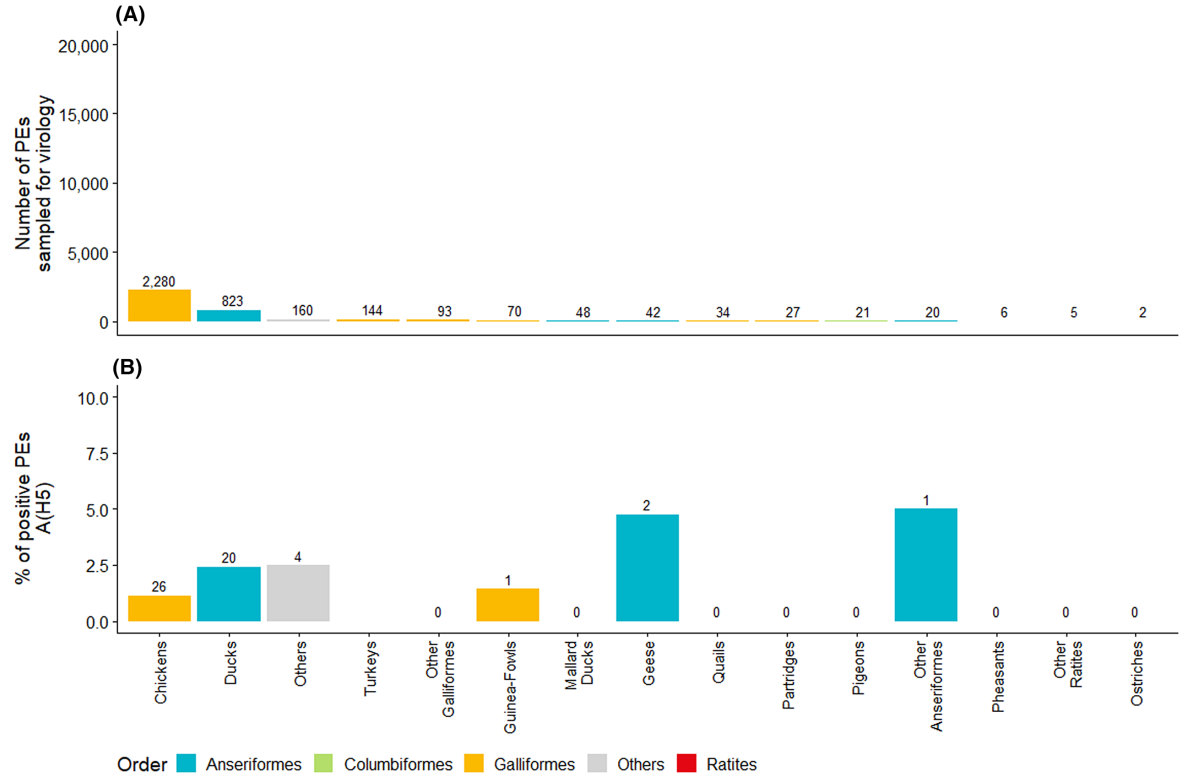


**FIGURE C.1** (A) Number of PEs sampled for virological survey by poultry species, (B) proportion of PEs sampled that tested positive for influenza A(H5) viruses by virology. The numbers above bars indicate the numbers of positive PEs. Bars are colour-coded to identify the order the species belong to. 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 D

## Total number of wild birds of the different orders sampled by passive and active surveillance

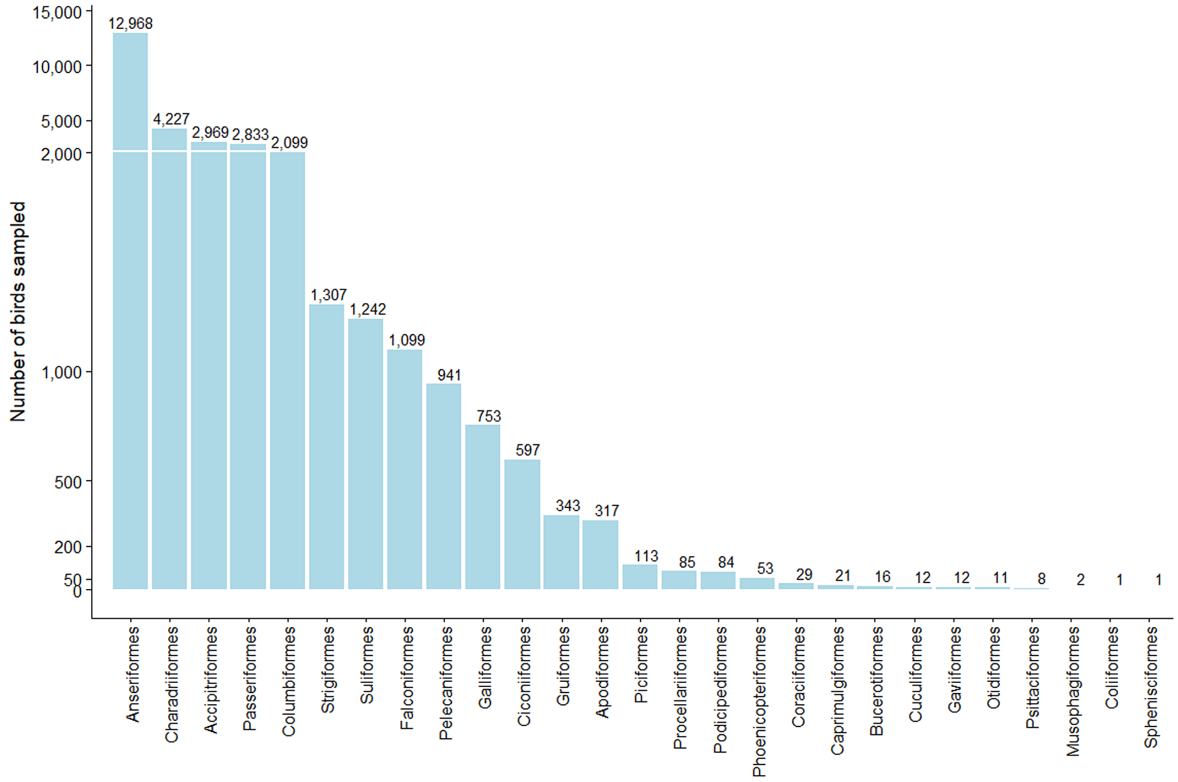


**FIGURE D.1** Total number of wild birds of the different orders sampled by passive and active surveillance by RCs in 2022. The *y*-axis is presented on a non-linear scale to improve visibility.

# APPENDIX E

## Scientific and common names of wild bird species

**TABLE E.1** English common names and scientific names of wild bird species sampled in 2022.

| Scientific name | English common name |
|---|---|
| *Acanthis flammea* | Redpoll |
| *Accipiter gentilis* | Northern goshawk |
| *Accipiter nisus* | Eurasian sparrowhawk |
| *Acridotheres cristatellus* | Crested myna |
| *Acrocephalus arundinaceus* | Great reed-warbler |
| *Acrocephalus palustris* | Marsh warbler |
| *Acrocephalus scirpaceus* | Common reed-warbler |
| *Actitis hypoleucos* | Common sandpiper |
| *Aegithalos caudatus* | Long-tailed tit |
| *Aegolius funereus* | Boreal owl |
| *Aegypius monachus* | Cinereous vulture |
| *Agropsar sturninus* | Purple-backed starling |
| *Aix galericulata* | Mandarin duck |
| *Aix sponsa* | Wood duck |
| *Alauda arvensis* | Eurasian skylark |
| *Alca torda* | Razorbill |
| *Alcedo atthis* | Common kingfisher |
| *Alectoris chukar* | Chukar |
| *Alectoris rufa* | Red-legged partridge |
| *Alle alle* | Little auk |
| *Alopochen aegyptiaca* | Egyptian goose |
| *Amazona oratrix* | Yellow-headed amazon |
| *Anas acuta* | Northern pintail |
| *Anas crecca* | Common teal |
| *Anas platyrhynchos* | Mallard |
| *Anser albifrons* | Greater white-fronted goose |
| *Anser anser* | Greylag goose |
| *Anser brachyrhynchus* | Pink-footed goose |
| *Anser caerulescens* | Snow goose |
| *Anser cygnoides* | Swan goose |
| *Anser erythropus* | Lesser white-fronted goose |
| *Anser fabalis* | Bean goose |
| *Anser indicus* | Bar-headed goose |
| *Anthus pratensis* | Meadow pipit |
| *Anthus trivialis* | Tree pipit |
| *Apus apus* | Common swift |
| *Apus pallidus* | Pallid swift |
| *Aquila adalberti* | Spanish imperial eagle |
| *Aquila chrysaetos* | Golden eagle |
| *Aquila fasciata* | Bonelli's eagle |
| *Aquila heliaca* | Eastern imperial eagle |
| *Ardea alba* | Great white egret |
| *Ardea cinerea* | Grey heron |
| *Ardea purpurea* | Purple heron |

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Ardenna gravis* | Great shearwater |
| *Arenaria interpres* | Ruddy turnstone |
| *Asio flammeus* | Short-eared owl |
| *Asio otus* | Northern long-eared owl |
| *Athene noctua* | Little owl |
| *Aythya ferina* | Common pochard |
| *Aythya fuligula* | Tufted duck |
| *Aythya marila* | Greater scaup |
| *Aythya nyroca* | Ferruginous duck |
| *Bombycilla garrulus* | Bohemian waxwing |
| *Bonasa bonasia* | Hazel grouse |
| *Botaurus stellaris* | Eurasian bittern |
| *Branta bernicla* | Brent goose |
| *Branta canadensis* | Canada goose |
| *Branta hutchinsii* | Cackling goose |
| *Branta leucopsis* | Barnacle goose |
| *Branta ruficollis* | Red-breasted goose |
| *Bubo bubo* | Eurasian eagle-owl |
| *Bubo lacteus* | Verreaux's eagle-owl |
| *Bubo scandiacus* | Snowy owl |
| *Bubulcus ibis* | Cattle egret |
| *Bucephala clangula* | Common goldeneye |
| *Bucorvus abyssinicus* | Abyssinian ground hornbill |
| *Burhinus oedicnemus* | Eurasian thick-knee |
| *Buteo buteo* | Eurasian buzzard |
| *Buteo lagopus* | Rough-legged buzzard |
| *Buteo regalis* | Ferruginous hawk |
| *Buteo rufinus* | Long-legged buzzard |
| *Butorides striata* | Green-backed heron |
| *Cairina moschata* | Muscovy duck |
| *Calidris alba* | Sanderling |
| *Calidris alpina* | Dunlin |
| *Calidris canutus* | Red knot |
| *Calidris ferruginea* | Curlew sandpiper |
| *Calidris minuta* | Little stint |
| *Calidris pugnax* | Ruff |
| *Calonectris borealis* | Cory's shearwater |
| *Calonectris diomedea* | Scopoli's shearwater |
| *Caprimulgus europaeus* | European nightjar |
| *Caprimulgus ruficollis* | Red-necked nightjar |
| *Carduelis carduelis* | European goldfinch |
| *Catharacta skua* | Great skua |
| *Cepphus grylle* | Black guillemot |
| *Certhia brachydactyla* | Short-toed treecreeper |
| *Charadrius dubius* | Little ringed plover |
| *Charadrius hiaticula* | Common ringed plover |
| *Charadrius pecuarius* | Kittlitz's plover |
| *Chlidonias niger* | Black tern |
| *Chloris chloris* | European greenfinch |

(Continues)

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Ciconia ciconia* | White stork |
| *Ciconia nigra* | Black stork |
| *Circaetus gallicus* | Short-toed snake-eagle |
| *Circus aeruginosus* | Western marsh-harrier |
| *Circus cyaneus* | Hen harrier |
| *Circus pygargus* | Montagu's harrier |
| *Clamator glandarius* | Great spotted cuckoo |
| *Clangula hyemalis* | Long-tailed duck |
| *Coccothraustes coccothraustes* | Hawfinch |
| *Colius striatus* | Speckled mousebird |
| *Columba livia* | Rock dove |
| *Columba oenas* | Stock dove |
| *Columba palumbus* | Common woodpigeon |
| *Coracias garrulus* | European roller |
| *Corvus corax* | Common raven |
| *Corvus corone* | Carrion crow |
| *Corvus coronus* | Hooded crow |
| *Corvus frugilegus* | Rook |
| *Corvus monedula* | Eurasian jackdaw |
| *Coturnix coturnix* | Common quail |
| *Crex crex* | Corncrake |
| *Cuculus canorus* | Common cuckoo |
| *Cyanistes caeruleus* | Eurasian blue tit |
| *Cyanistes cyanus* | Azure tit |
| *Cyanopica cooki* | Iberian azure-winged magpie |
| *Cygnus atratus* | Black swan |
| *Cygnus cygnus* | Whooper swan |
| *Cygnus olor* | Mute swan |
| *Delichon urbicum* | Northern house martin |
| *Dendrocopos leucotos* | White-backed woodpecker |
| *Dendrocopos major* | Great spotted woodpecker |
| *Dryobates minor* | Lesser spotted woodpecker |
| *Dryocopus martius* | Black woodpecker |
| *Egretta garzetta* | Little egret |
| *Elanus caeruleus* | Black-winged kite |
| *Emberiza citrinella* | Yellowhammer |
| *Emberiza hortulana* | Ortolan bunting |
| *Emberiza schoeniclus* | Reed bunting |
| *Erithacus rubecula* | European robin |
| *Eudyptes chrysocome* | Southern rockhopper penguin |
| *Falco biarmicus* | Lanner falcon |
| *Falco columbarius* | Merlin |
| *Falco eleonorae* | Eleonora's falcon |
| *Falco naumanni* | Lesser kestrel |
| *Falco peregrinus* | Peregrine falcon |
| *Falco rusticolus* | Gyrfalcon |
| *Falco sparverius* | American kestrel |
| *Falco subbuteo* | Eurasian hobby |
| *Falco tinnunculus* | Common kestrel |

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Falco vespertinus* | Red-footed falcon |
| *Ficedula hypoleuca* | European pied flycatcher |
| *Francolinus francolinus* | Black francolin |
| *Fratercula arctica* | Atlantic puffin |
| *Fringilla coelebs* | Common chaffinch |
| *Fringilla montifringilla* | Brambling |
| *Fulica atra* | Common coot |
| *Fulica cristata* | Red-knobbed coot |
| *Fulmarus glacialis* | Northern fulmar |
| *Galerida cristata* | Crested lark |
| *Gallinago gallinago* | Common snipe |
| *Gallinago media* | Great snipe |
| *Gallinula chloropus* | Common moorhen |
| *Garrulus glandarius* | Eurasian jay |
| *Gavia arctica* | Arctic loon |
| *Gavia stellata* | Red-throated loon |
| *Gelochelidon nilotica* | Common gull-billed tern |
| *Geronticus eremita* | Northern bald ibis |
| *Glaucidium passerinum* | Eurasian pygmy-owl |
| *Grus grus* | Common crane |
| *Grus virgo* | Demoiselle crane |
| *Gypaetus barbatus* | Bearded vulture |
| *Gyps fulvus* | Griffon vulture |
| *Gyps rueppelli* | Rüppell's vulture |
| *Haematopus ostralegus* | Eurasian oystercatcher |
| *Haliaeetus albicilla* | White-tailed eagle |
| *Haliaeetus leucocephalus* | Bald eagle |
| *Haliaeetus leucoryphus* | Pallas's fish-eagle |
| *Hieraaetus pennatus* | Booted eagle |
| *Himantopus himantopus* | Black-winged stilt |
| *Hippolais icterina* | Icterine warbler |
| *Hirundo rustica* | Barn swallow |
| *Histrionicus histrionicus* | Harlequin duck |
| *Hydrobates castro* | Band-rumped storm-petrel |
| *Hydrobates leucorhous* | Leach's storm-petrel |
| *Hydrobates pelagicus* | European storm-petrel |
| *Hydrocoloeus minutus* | Little gull |
| *Hydroprogne caspia* | Caspian tern |
| *Ixobrychus* | Bittern |
| *Ixobrychus minutus* | Common little bittern |
| *Jacana jacana* | Wattled jacana |
| *Jynx torquilla* | Eurasian wryneck |
| *Lagopus muta* | Rock ptarmigan |
| *Lanius excubitor* | Great grey shrike |
| *Lanius minor* | Lesser grey shrike |
| *Lanius senator* | Woodchat shrike |
| *Larus argentatus* | European herring gull |
| *Larus audouinii* | Audouin's gull |
| *Larus cachinnans* | Caspian gull |

(Continues)

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Larus californicus* | California gull |
| *Larus canus* | Mew gull |
| *Larus fuscus* | Lesser black-backed gull |
| *Larus glaucescens* | Glaucous-winged gull |
| *Larus marinus* | Great black-backed gull |
| *Larus melanocephalus* | Mediterranean gull |
| *Larus michahellis* | Yellow-legged gull |
| *Larus ridibundus* | Black-headed gull |
| *Leiopicus medius* | Middle spotted woodpecker |
| *Leptoptilos crumenifer* | Marabou |
| *Limosa lapponica* | Bar-tailed godwit |
| *Limosa limosa* | Black-tailed godwit |
| *Linaria cannabina* | Common linnet |
| *Loxia curvirostra* | Red crossbill |
| *Luscinia luscinia* | Thrush nightingale |
| *Luscinia megarhynchos* | Common nightingale |
| *Lyrurus tetrix* | Black grouse |
| *Mareca penelope* | Eurasian wigeon |
| *Mareca strepera* | Gadwall |
| *Marmaronetta angustirostris* | Marbled teal |
| *Melanitta fusca* | Velvet scoter |
| *Melanitta nigra* | Common scoter |
| *Mergus merganser* | Goosander |
| *Mergus serrator* | Red-breasted merganser |
| *Merops apiaster* | European bee-eater |
| *Microcarbo niger* | Little cormorant |
| *Milvus migrans* | Black kite |
| *Milvus milvus* | Red kite |
| *Momotus momota* | Amazonian motmot |
| *Morus bassanus* | Northern gannet |
| *Morus capensis* | Cape gannet |
| *Motacilla alba* | White wagtail |
| *Motacilla cinerea* | Grey wagtail |
| *Motacilla flava* | Western yellow wagtail |
| *Muscicapa striata* | Spotted flycatcher |
| *Musophaga violacea* | Violet turaco |
| *Myiopsitta monachus* | Monk parakeet |
| *Neophron percnopterus* | Egyptian vulture |
| *Netta rufina* | Red-crested pochard |
| *Ninox scutulata* | Brown hawk-owl |
| *Numenius arquata* | Eurasian curlew |
| *Numenius phaeopus* | Whimbrel |
| *Nycticorax nycticorax* | Black-crowned night-heron |
| *Oceanites oceanicus* | Wilson's storm-petrel |
| *Oenanthe oenanthe* | Northern wheatear |
| *Oriolus oriolus* | Eurasian golden oriole |
| *Otis tarda* | Great bustard |
| *Otus scops* | Eurasian scops-owl |
| *Oxyura jamaicensis* | Ruddy duck |

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Oxyura leucocephala* | White-headed duck |
| *Pandion haliaetus* | Osprey |
| *Panurus biarmicus* | Bearded reedling |
| *Parabuteo unicinctus* | Harris's hawk |
| *Parus major* | Great tit |
| *Passer domesticus* | House sparrow |
| *Passer hispaniolensis* | Spanish sparrow |
| *Passer montanus* | Eurasian tree sparrow |
| *Pastor roseus* | Rosy starling |
| *Pavo cristatus* | Peafowl |
| *Pelecanus crispus* | Dalmatian pelican |
| *Pelecanus onocrotalus* | Great white pelican |
| *Perdicinae* | Partridge |
| *Perdix perdix* | Grey partridge |
| *Periparus ater* | Coal tit |
| *Pernis apivorus* | European honey-buzzard |
| *Phalacrocorax aristotelis* | European shag |
| *Phalacrocorax carbo* | Great cormorant |
| *Phalaropus fulicarius* | Red phalarope |
| *Phalaropus lobatus* | Red-necked phalarope |
| *Phasianus colchicus* | Common pheasant |
| *Phasianus versicolor* | Green pheasant |
| *Phoenicopterus roseus* | Greater flamingo |
| *Phoenicopterus ruber* | American flamingo |
| *Phoenicurus ochruros* | Black redstart |
| *Phoenicurus phoenicurus* | Common redstart |
| *Phylloscopus collybita* | Common chiffchaff |
| *Phylloscopus sibilatrix* | Wood warbler |
| *Phylloscopus trochilus* | Willow warbler |
| *Pica pica* | Eurasian magpie |
| *Picus canus* | Grey-faced woodpecker |
| *Picus viridis* | Eurasian green woodpecker |
| *Platalea leucorodia* | Eurasian spoonbill |
| *Platelea ajaja* | Roseate spoonbill |
| *Plectrophenax nivalis* | Snow bunting |
| *Plegadis falcinellus* | Glossy ibis |
| *Pluvialis apricaria* | Eurasian golden plover |
| *Pluvialis squatarola* | Grey plover |
| *Podiceps cristatus* | Great crested grebe |
| *Podiceps nigricollis* | Black-necked grebe |
| *Poecile montanus* | Willow tit |
| *Porphyrio porphyrio* | Purple swamphen |
| *Psittacara mitratus* | Mitred parakeet |
| *Psittacula eupatria* | Alexandrine parakeet |
| *Psittacula krameri* | Rose-ringed parakeet |
| *Psittacus erithacus* | Grey parrot |
| *Puffinus mauretanicus* | Balearic shearwater |
| *Puffinus puffinus* | Manx shearwater |
| *Pyrrhocorax graculus* | Yellow-billed chough |

(Continues)

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Pyrrhocorax pyrrhocorax* | Red-billed chough |
| *Pyrrhula pyrrhula* | Eurasian bullfinch |
| *Rallus aquaticus* | Western water rail |
| *Recurvirostra avosetta* | Pied avocet |
| *Regulus ignicapilla* | Common firecrest |
| *Regulus regulus* | Goldcrest |
| *Riparia riparia* | Collared sand martin |
| *Rissa tridactyla* | Black-legged kittiwake |
| *Sagittarius serpentarius* | Secretarybird |
| *Saxicola torquatus* | Common stonechat |
| *Scolopax rusticola* | Eurasian woodcock |
| *Serinus serinus* | European serin |
| *Sitta europaea* | Eurasian nuthatch |
| *Somateria mollissima* | Common eider |
| *Spatula clypeata* | Northern shoveler |
| *Spatula querquedula* | Garganey |
| *Spinus spinus* | Eurasian siskin |
| *Stercorarius longicaudus* | Long-tailed jaeger |
| *Stercorarius parasiticus* | Arctic jaeger |
| *Sterna dougallii* | Roseate tern |
| *Sterna hirundo* | Common tern |
| *Sterna paradisaea* | Arctic tern |
| *Sternula albifrons* | Little tern |
| *Streptopelia decaocto* | Eurasian collared-dove |
| *Streptopelia turtur* | European turtle-dove |
| *Strix aluco* | Tawny owl |
| *Strix nebulosa* | Great grey owl |
| *Strix uralensis* | Ural owl |
| *Sturnus unicolor* | Spotless starling |
| *Sturnus vulgaris* | Common starling |
| *Surnia ulula* | Northern hawk-owl |
| *Sylvia atricapilla* | Eurasian blackcap |
| *Sylvia communis* | Common whitethroat |
| *Sylvia melanocephala* | Sardinian warbler |
| *Tachybaptus ruficollis* | Little grebe |
| *Tachymarptis melba* | Alpine swift |
| *Tadorna cana* | South African shelduck |
| *Tadorna tadorna* | Common shelduck |
| *Tauraco persa* | Guinea turaco |
| *Tetrao urogallus* | Western capercaillie |
| *Tetrax tetrax* | Little bustard |
| *Thalasseus sandvicensis* | Sandwich tern |
| *Threskiornis aethiopicus* | African sacred ibis |
| *Tringa ochropus* | Green sandpiper |
| *Tringa totanus* | Common redshank |
| *Troglodytes troglodytes* | Northern wren |
| *Turdus merula* | Eurasian blackbird |
| *Turdus philomelos* | Song thrush |
| *Turdus pilaris* | Fieldfare |

**TABLE E.1** (Continued)

| Scientific name | English common name |
|---|---|
| *Turdus viscivorus* | Mistle thrush |
| *Tyto alba* | Common barn-owl |
| *Upupa epops* | Common hoopoe |
| *Uria aalge* | Common murre |
| *Uria lomvia* | Thick-billed murre |
| *Vanellus vanellus* | Northern lapwing |
| *Zenaida aurita* | Zenaida dove |

# APPENDIX F

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

**TABLE F.1** List of target wild bird species published in December 2017 as part of the EFSA-ECDC-EURL scientific report (species not sampled in 2022 are highlighted in grey).

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

**TABLE F.1** (Continued)

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

# APPENDIX G

## Wild bird observations by voluntary contributors

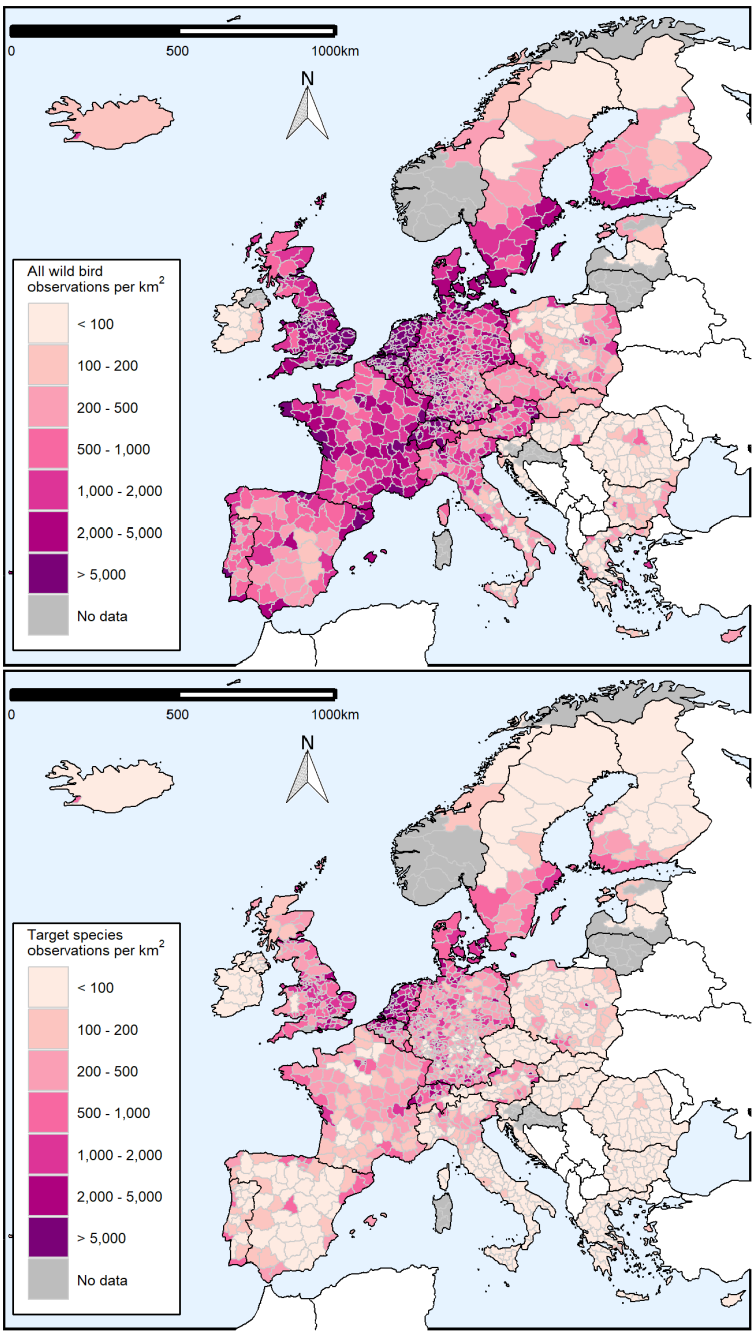


**FIGURE G.1** Density of wild bird observations for 2022 by NUTS3 region, as per data provided by the EBP project. The density of observations was estimated as the total number of observations in the NUTS3 region divided by the surface of the area. The upper map shows all wild bird species, while the lower map is restricted to species from the EFSA target list.

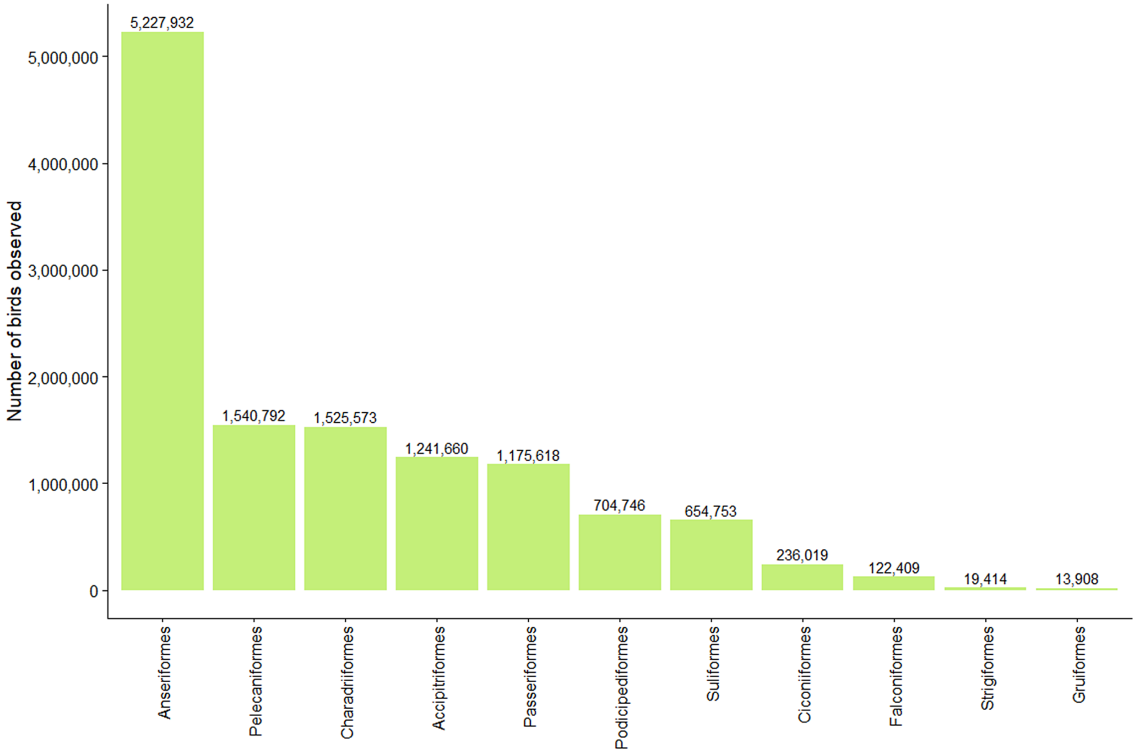


**FIGURE G.2** Number of wild birds from the EFSA list of target wild bird species ($n = 50$) observed in 2022 and recorded in the EBP project, aggregated by wild bird order.

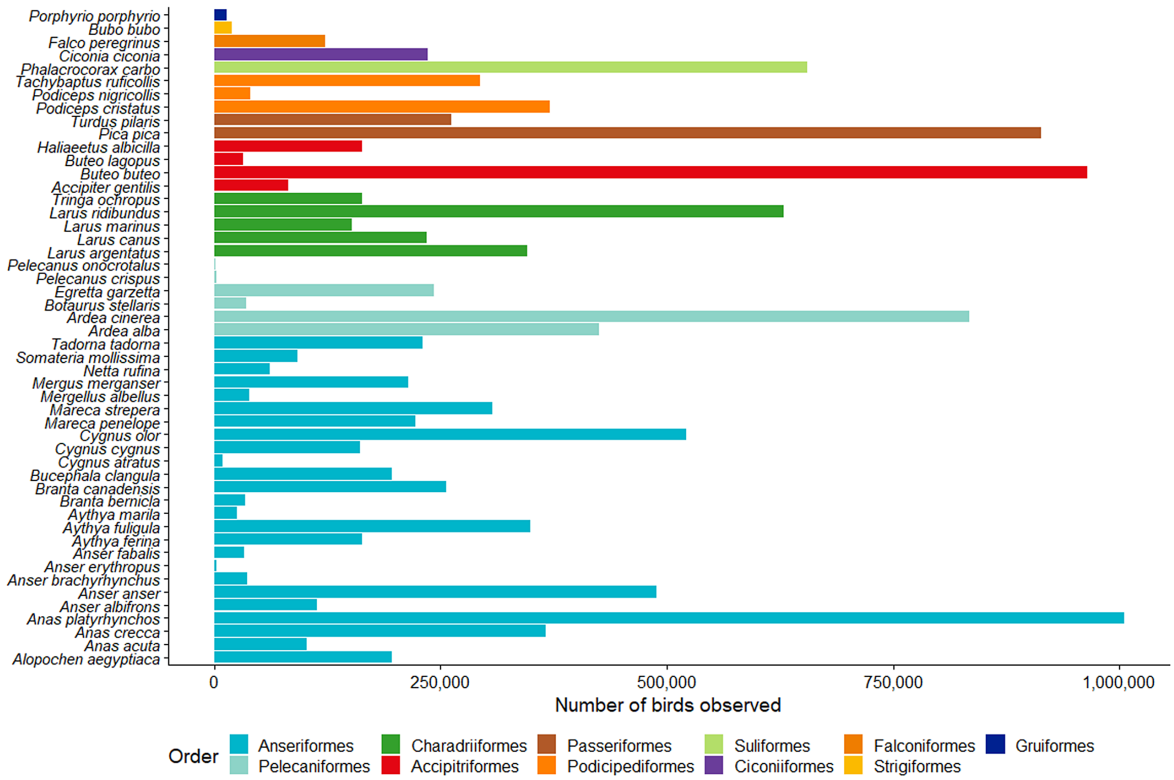


**FIGURE G.3** Number of wild birds from the EFSA list of target wild bird species ($n = 50$) observed in 2022 and recorded in the EBP project, aggregated by wild bird species.

# APPENDIX H

## Wild bird species detected positive for highly pathogenic avian influenza virus by passive surveillance

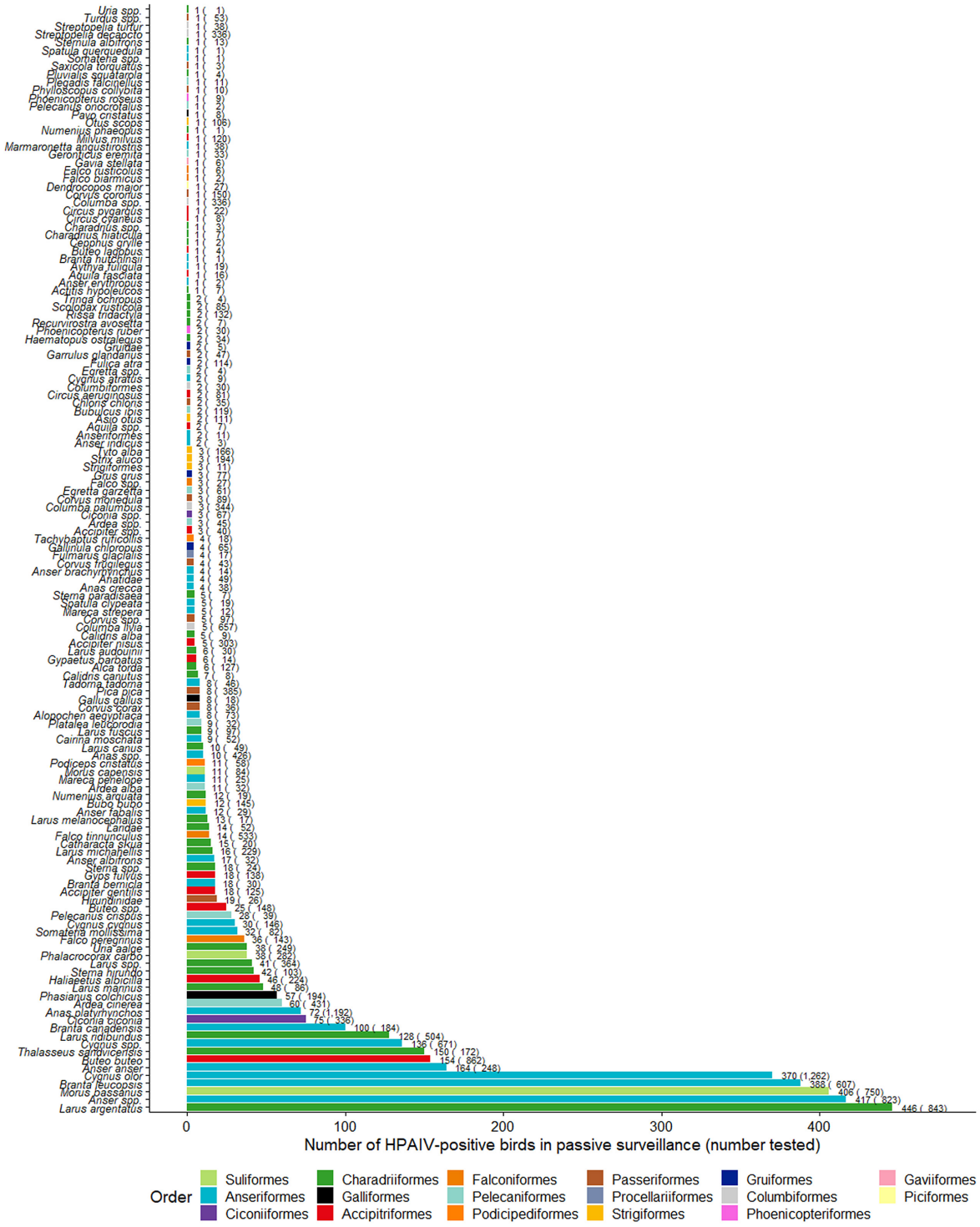


**FIGURE H.1** Number of HPAIV-positive wild birds detected by *passive* surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing numbers of positive wild birds and colour-coded to identify the order the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

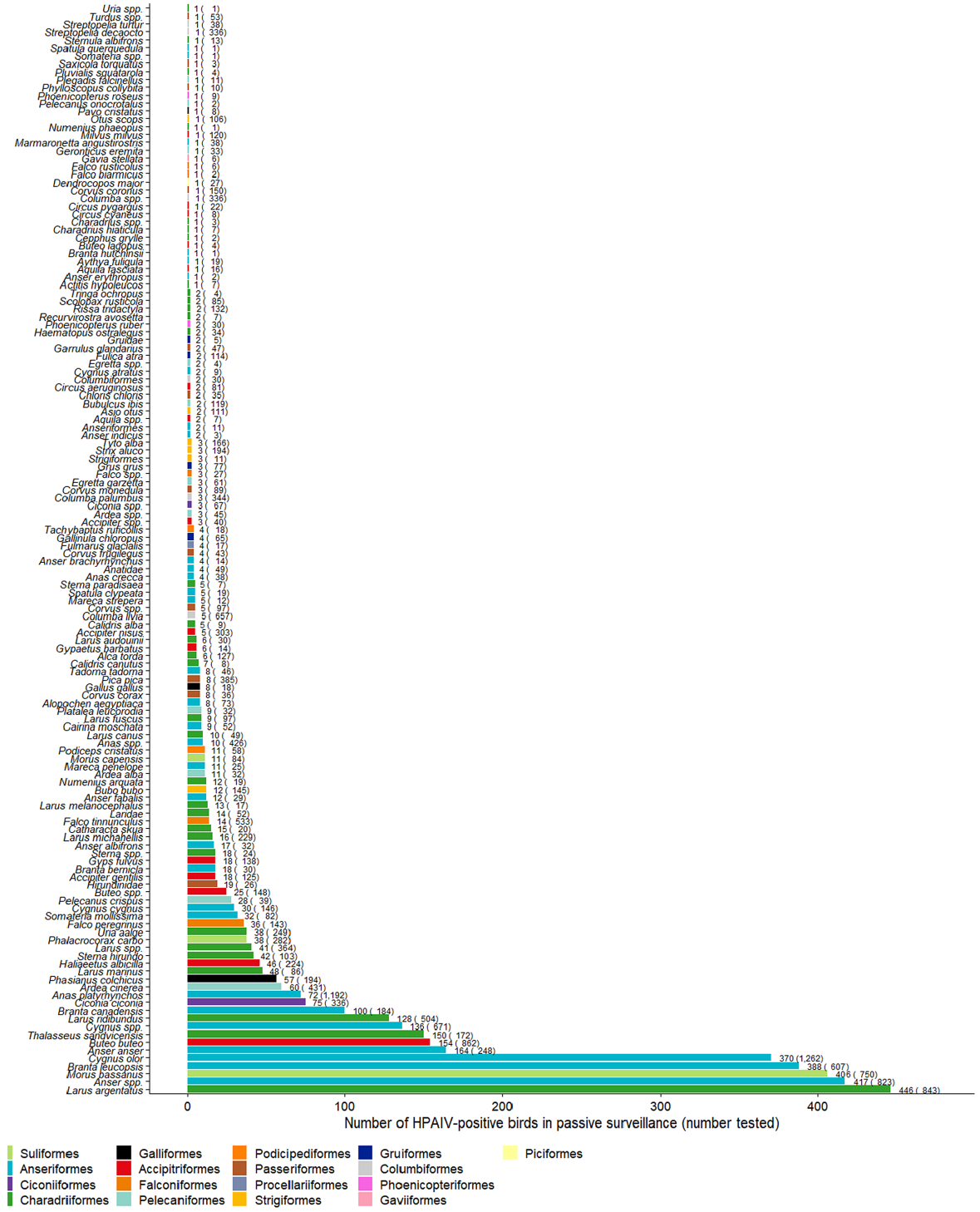


**FIGURE H.2** Proportion of HPAIV-positive wild birds detected among wild birds tested by *passive* surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing proportions of positive wild birds and colour-coded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

# APPENDIX I

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

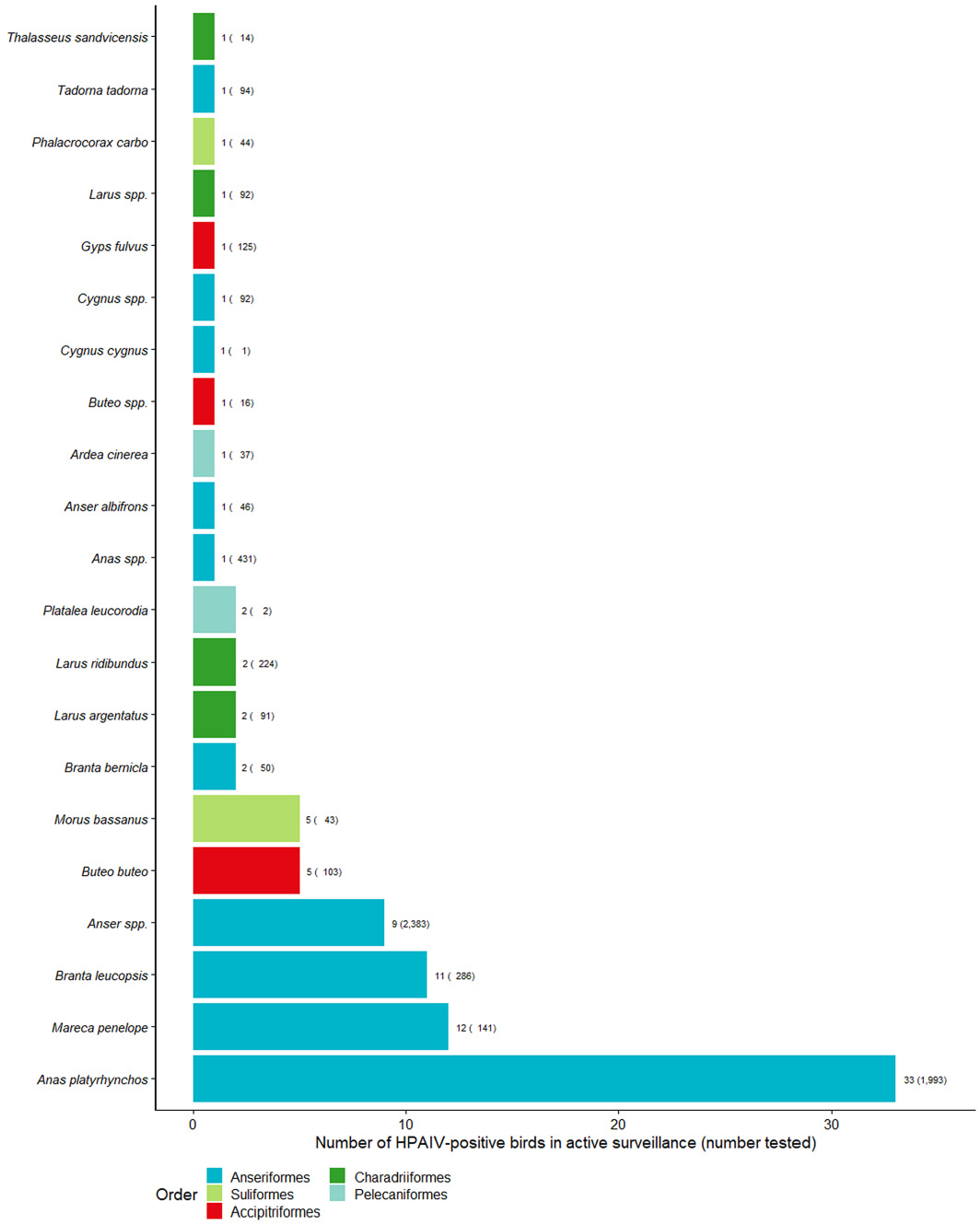


**FIGURE I.1** Number of HPAIV-positive wild birds detected in *active* surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing numbers of positive wild birds and colour-coded to identify the order the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

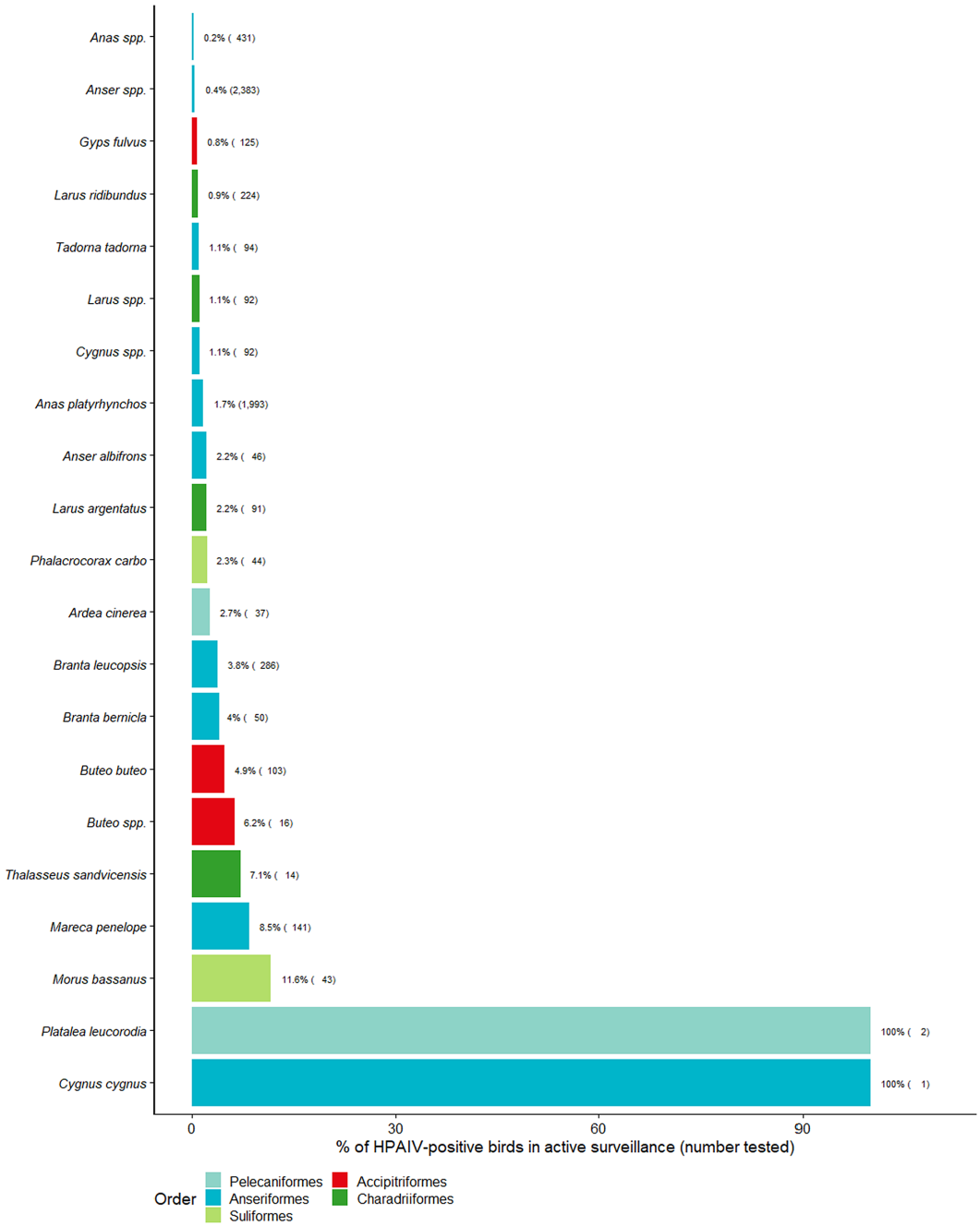


**FIGURE I.2** Proportion of HPAIV-positive (all types) wild birds detected among birds tested in *active* surveillance, for species with at least one HPAIV-positive sample. The number of wild birds tested is indicated in brackets. Bars are ordered by increasing proportions of positive wild birds and colour-coded to identify the order the species belongs.