Approved: 24 April 2024

DOI: 10.2903/j.efsa.2024.8809

efsa JOURNAL

SCIENTIFIC REPORT

Epidemiological analysis of African swine fever in the European Union during 2023

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Abstract

In 2023, 14 Member States were affected by African swine fever (ASF), including Croatia and Sweden where ASF emerged (wild boar outbreaks only) and Greece where ASF re-emerged after being free since 2021. The number of ASF outbreaks among domestic pigs in the EU was five times higher than in 2022, reaching a similar magnitude to that in 2019. This was predominantly driven by the introduction and subsequent spread of ASF in Croatia and its resurgence in Romania, representing 96% of the EU outbreaks. ASF outbreaks in domestic pigs were clearly seasonal in all countries, with 88% of outbreaks reported between July and October. Most of the ASF outbreaks among domestic pigs were detected through clinical suspicion (94%), followed by tracing from affected establishments (3%), and the weekly testing of at least two dead pigs in establishments (3%). In wild boar, a 10% increase in the number of notified outbreaks was observed in the EU in comparison with 2022, with considerable variations between countries. A winter peak was observed only in Poland, Slovakia and Hungary. The epidemiological situation in wild boar improved in Germany and Hungary, as suggested by the decrease in the number of outbreaks and in the proportions of PCR-positive samples from dead wild boar. Overall, 31% of wild boar carcasses found during passive surveillance tested positive by PCR, representing 69% of the ASF outbreaks in wild boar in the EU. In contrast, 0.4% of hunted wild boar tested positive, representing 31% of the outbreaks. Despite the introduction of ASF into new countries and the increase in the number of outbreaks, the size of restricted zones in the EU remained stable, due to the highly clustered outbreaks in Croatia, and the reduction of restricted zones in Poland, Slovakia and Bulgaria (in domestic pigs), and Hungary (in wild boar).

KEYWORDS

ASF, epidemiology, monitoring, pigs, surveillance, wild boar

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SUMMARY

The European Food Safety Authority (EFSA) has a mandate from the European Commission (EC) to generate annual epidemiological analyses of the spread and impact of African swine fever (ASF) genotype II in the European Union (EU) and neighbouring countries affected by ASF. In this context, affected Member States and non-EU countries and territories that notified ASF during 2023 to the Animal Disease Information System (ADIS) and, where relevant, benefit from the Instrument for Pre-accession Assistance programme, were invited to submit laboratory test results from ASF surveillance activities and pig population information to EFSA. These data were used in combination with other data sources to produce this report. These additional sources include official ASF outbreaks and outbreak information among wild boar and domestic pigs (ADIS), the wild boar hunting bags and abundance estimates (ENETWILD et al., 2022) and restricted zone data (as provided by European Commission).

The number of notified outbreaks of ASF among domestic pigs in the Member States was five times higher than in 2022, reaching a similar magnitude to that in 2019. This increase was largely driven by the ASF emergence in Croatia (1124 outbreaks) and the resurgence in Romania (736 outbreaks), as these two countries accounted for 96% of the EU outbreaks in 2023. While all the outbreaks in Croatia were notified only in three regions bordering Bosnia and Herzegovina and Serbia, the outbreaks in Romania were reported across the country, similar to the situation in 2022. In the rest of the EU, the outbreaks among domestic pigs were sporadic (30 in Poland, 16 in Italy and fewer than 10 in the remaining 6 affected Member States). Across the EU, ASF in domestic pigs was notified in 11 NUTS 3 regions that had never been affected before (compared with 5 in 2022), located in Croatia, Greece, Germany, Italy and Poland, indicating a wider spread to new areas. Most of the outbreaks (96%) occurred on small establishments with fewer than 100 pigs, and the six outbreaks that occurred on establishments with more than 10,000 pigs were all in Romania.

In the non-EU countries and territories, ASF was detected for the first time in Bosnia and Herzegovina and Kosovo.[1]* A very important increase was observed in the number of notified outbreaks (18 times more), driven by the emergence and spread in Bosnia and Herzegovina and the sharp increase in incidence in Serbia (nine times more outbreaks than in 2022). These two countries accounted for 99% of the notified outbreaks in domestic pigs among the non-EU countries and territories included in the report.

In the Member States, 94% of the outbreaks among domestic pigs were detected through passive surveillance based on clinical suspicion, 3% were identified through contact tracing from affected establishments, and 3% (54 outbreaks) were found as the result of enhanced passive surveillance based on the weekly testing of at least two dead pigs per establishment. In the EU, all 6 outbreaks that occurred in establishments with more than 10,000 pigs and 5 out of the 12 outbreaks that occurred in establishments with between 1000 and 10,000 pigs were detected through the enhanced passive surveillance. No outbreaks were detected through active surveillance targeting healthy pigs at slaughter, before movement, or randomly selected at establishments. A clear summer seasonality of ASF in domestic pigs was observed, with 88% of the outbreaks reported between July and October. This seasonality was particularly clear for the small-scale establishments of fewer than 100 pigs, which accounted for most of the outbreaks notified in the EU (96%).

In wild boar, despite the introduction into new countries (Croatia, Greece and Sweden) and the spread in new areas of Italy, only a small increase (10%) in the number of notified outbreaks was observed in the EU in comparison with 2022, with considerable variations between countries. In 2023, ASF was notified in wild boar in 17 NUTS 3 regions that had never been affected before (compared with 14 regions in 2022), located in Croatia, Sweden, Italy, Germany, Greece, Poland and Slovakia. In the non-EU countries and territories, ASF was notified in wild boar in Bosnia and Herzegovina and in some new areas of north-west Serbia, with an increase in the number of notified outbreaks. Among Member States, Poland notified the largest number of ASF outbreaks in wild boar with 2686 outbreaks, representing 34% of the outbreaks in the EU. In the non-EU countries and territories, Serbia notified 213 outbreaks among wild boar, representing 70% of the outbreaks outside the EU.

Around 92% of the wild boar samples analysed were taken from hunted wild boar. Around 0.4% of them tested positive by PCR leading to the detection of 31% of the wild boar outbreaks. In contrast, samples taken from found-dead and road-killed wild boar accounted for 7.9% of the wild boar samples analysed. Around 31% of them tested positive by PCR leading to the detection of 69% of the wild boar outbreaks in the EU. A clear seasonality with winter/early spring peaks in the proportion of PCR-positive samples was observed in Poland, Slovakia and Hungary. However, no clear seasonal patterns could be observed in the other affected Member States. Seasonal patterns probably reflect a combination of ecological factors (e.g. seasonality in transmission rates or in carcass detection probability due to vegetation) and human factors (e.g. seasonality in carcass search effort and hunting intensity). In Germany and Hungary, a decreasing trend in both the proportion of PCR-positive samples from dead wild boar and the total number of notified outbreaks was observed. In Slovakia, a similar improvement was observed in the proportion of PCR-positive samples, but only since 2022.

Despite the introduction of ASF into previously unaffected countries and the increase in the number of outbreaks, particularly in domestic pigs, the restricted zones in the EU remained relatively stable. The total size of the restricted zones III, reflecting ASF in domestic pigs, was slightly reduced (−4%). This was influenced by the highly clustered outbreaks in Croatia, and the reduction of the restricted zone III in Poland, Slovakia and Bulgaria. The size of restricted zone II, reflecting ASF presence in wild boar, slightly increased in 2023 due to the new countries affected (Sweden, Croatia and Greece) and spread in previously affected ones (Italy, Slovakia and Lithuania), while it decreased in Hungary.

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

A decrease in the number of pig establishments, especially small establishments (< 100 pigs), was observed in Lithuania (–20%), Latvia (–17%) and Italy (–19%). In contrast, the number of small establishments increased in Romania (+27%), simultaneously with an increase in the incidence of ASF (from 0.1% to 0.2%) in comparison with 2022. The direct losses were highly concentrated in areas where the larger outbreaks were notified (e.g. the biggest outbreaks with more than 10,000 pigs were located in four regions of Romania).

In the Member States, the overall number of dead or killed wild boar positive to ASF notified to ADIS increased by 9% compared to 2022. However, there is considerable variation between countries. In Germany, this metric decreased by 44% between 2022 and 2023. In contrast, in Bulgaria, Poland and Italy, it increased by 73%, 60% and 290%, respectively. The analysis of the annual hunting bags at country level identified an increase in the wild boar population in the Baltic States, a decrease in Germany, Hungary, Romania, Poland and Slovakia, and a stable trend in Bulgaria. The decreasing trends in Romania, Hungary and Slovakia since the introduction of ASF follow a similar pattern observed in the Baltics in the first few years post-introduction.

1 | INTRODUCTION

Since genotype II of African swine fever virus (ASFv) was detected in eastern Europe in 2007, the virus has spread to numerous countries in Europe and far beyond (Asia, the Americas and Oceania). In the European Union (EU), genotype II of ASFv was detected for the first time in 2014 in Eurasian wild boar (*Sus scrofa*) in Poland and the Baltic States. Since then, African swine fever (ASF) has been reported in several Member States, affecting kept and wild porcine animals (as defined in Article 4 of Regulation 2016/429[2]), here referred to as domestic pigs and wild boar.

No vaccine is available in Europe, and to date, no ASF vaccine is authorised for use in the EU or in any Member States.[3] The control of the disease in the EU follows a regionalisation approach, comprising a set of control measures mostly based on preventive biosecurity measures, restriction of the movement of domestic pigs and wild boar and their products within and from restriction zones, the culling of domestic pigs at affected establishments, and the management of wild boar populations. Therefore, the collection of samples and analysis of the surveillance data are critical for evaluating the evolution of the disease and monitor the effect of the control measures on the target animal populations.

From 2016, EFSA has been producing annual epidemiological reports summarising the evolution of the ASF situation in the EU, with a focus on ASFv genotype II, analysing epidemiological trends and studying the risk factors involved in the occurrence of the disease, its spread and persistence.[4] As specified in the mandate from the European Commission to EFSA and as mentioned in the protocol (EFSA, 2023a), only outbreaks caused by ASFv genotype II are included in this report. 'ASF' in this report refers to outbreaks of ASF caused by genotype II in Europe.

The current report focuses on the epidemiological assessment of ASF from 1 January to 31 December 2023 in the EU Member States that notified ASF outbreaks among domestic pigs or wild boar in 2023 via the Animal Diseases Information System (ADIS), herein referred to as 'affected countries'. In 2023, 14 Member States were affected by ASF: Czechia, Hungary, Slovakia and Sweden notified ASF outbreaks in wild boar only; while Bulgaria, Croatia, Estonia, Germany, Greece, Italy, Latvia, Lithuania, Poland and Romania notified ASF outbreaks among wild boar and domestic pigs.

In addition, four non-EU countries and territories that notified ASF during 2023 via ADIS and that benefit from the Instrument for Pre-accession Assistance programme, are also included in the report: Bosnia and Herzegovina, Kosovo,[1]* North Macedonia and Serbia.

2 | DATA AND METHODOLOGIES

The data and methodology used for the current report are detailed in the published protocol (EFSA, 2023a). In summary, the report focuses on the epidemiological situation of ASF genotype II for the year 2023 (from 1 January to 31 December), considering the previous years for historical comparison. Only the Member States and the neighbouring countries affected during 2023 and plotted in Figure 1 are included in the report.

[2]Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law'). OJ L 84, 31.3.2016, p. 1–208.

[3]ASF vaccines have been licensed and used in some countries in Asia affected by ASF.

[4]See the ASF page on the EFSA Journal website for further publications on the topic: https://efsa.onlinelibrary.wiley.com/doi/toc/10.2903/1831-4732.african-swine-fever.

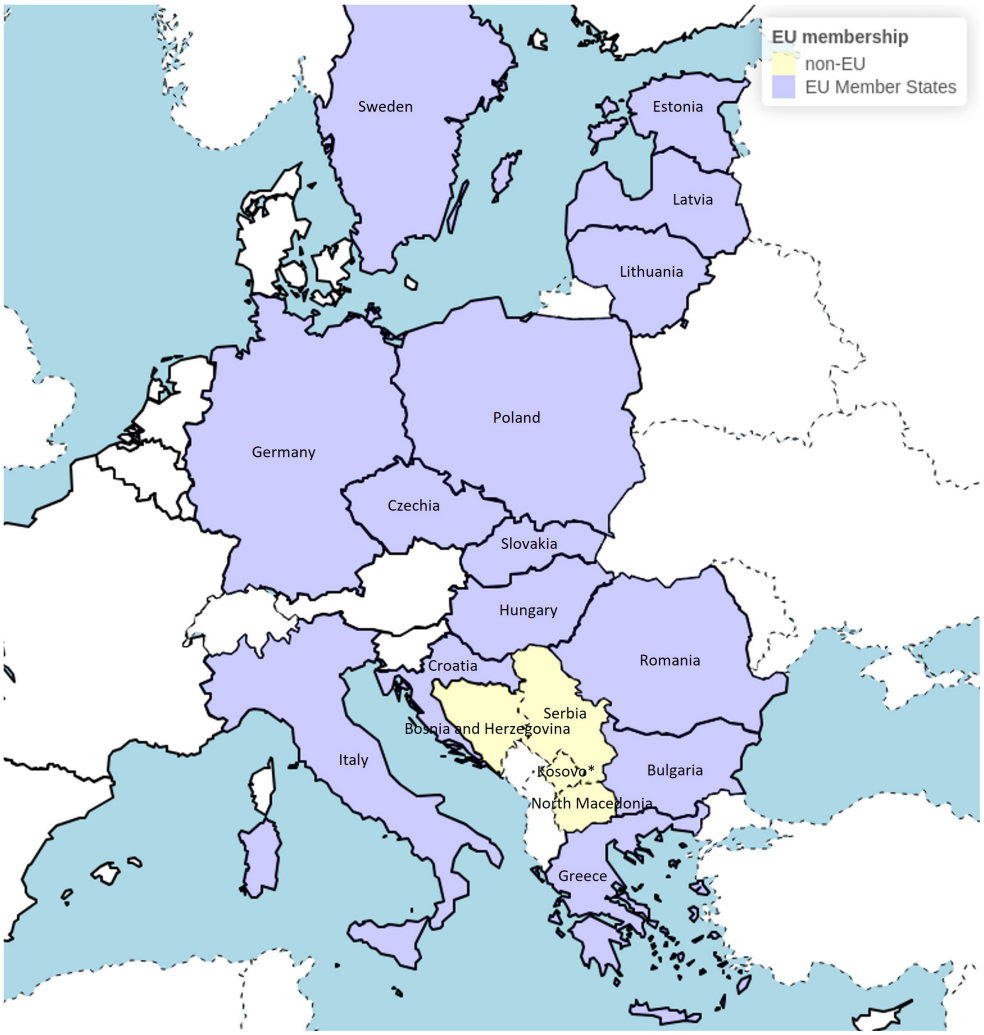

FIGURE 1 Countries and territories included in the report.
Disclaimer: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the European Food Safety Authority concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

To produce this report, six different data sources were used: (i) ASF laboratory results of samples for domestic pigs and wild boar submitted by affected countries to EFSA's Data Collection Framework (DCF) up to 31 January 2024 following the guidance for reporting laboratory data on ASF (EFSA, 2022a); (ii) data on the domestic pig population (location and type of establishments, number of animals, etc.) submitted by affected countries to the DCF up to 31 January 2024 following the guidance for reporting animal population data (EFSA, 2022b); (iii) data on ASF outbreaks confirmed in 2023 notified through the EU's ADIS, which was accessed on 4 April 2024; (iv) data on annual wild boar hunting bags (the number of harvested animals per km^2) that were collected by the ENETWILD Consortium up to 29 February 2024; (v) modelled wild boar abundance as published by the ENETWILD Consortium et al. (2022); and (vi) data on EU restricted zone measures for ASF that were provided by the Directorate-General for Health and Food Safety up to December 2023.[5]

In addition, members of the EFSA subgroup on ASF from the affected countries and territories were asked to complete an online questionnaire to share contextual information about their ASF surveillance activities and wild boar management strategies (the answers are given in Appendix A). A summary of the type of data available for each affected country can be found in Table 1.

[5]The latest version of the restricted zones can be consulted on https://santegis.maps.arcgis.com/apps/webappviewer/index.html?id=45cdd657542a437c84bfc9cf1846ae8c.

TABLE 1 Availability of the different data sources used in the report, by affected country or territory.

		Number of ASF outbreaks in domestic pigs	Number of ASF outbreaks in wild boar	Laboratory results from domestic pigs	Laboratory results from wild boar	Pig population data	Data on surveillance and wild boar management
EU Member States	Bulgaria	3	653				
	Croatia	1124	13				X
	Czechia		56	X	X	X	X
	Estonia	2	53	X	X	X	X
	Germany	1	888		X		X
	Greece	6	2		X	X	X
	Hungary		403	X	X		X
	Italy	16	1051	X	X	X	X
	Latvia	8	730	X	X	X	X
	Lithuania	3	436	X	X	X	X
	Poland	30	2686	X	X	X	X
	Romania	736	289	X	X	X	X
	Slovakia		535	X	X	X	X
	Sweden		60	X	X		X
Non-EU countries and territories	**Bosnia and Herzegovina**	1511	29				X
	Kosovo[1]*	9	4				X
	North Macedonia	19	47	X	X	X	X
	Serbia	992	213				X

Note: Countries newly affected in 2023 appear highlighted in bold. Data on surveillance and wild boar management were collected through an online questionnaire.

The data have been summarised in tables, maps and graphs, emphasising the major changes and evolution of the disease in EU Member States and non-EU countries and territories in 2023. Additional information on the methods, for which explanation is required (i.e. potential secondary outbreaks), can be found in the protocol (EFSA, 2023a). The rest of the analyses are descriptive and considered to be self-explanatory.

3 | ASSESSMENT

3.1 | Disease epidemiology and surveillance of ASF in domestic pigs

3.1.1 | Spatial distribution among domestic pigs

In 2023, ASF outbreaks among domestic pigs were confirmed and notified through ADIS by 10 Member States (Bulgaria, Croatia, Estonia, Germany, Greece, Italy, Latvia, Lithuania, Poland and Romania), with Croatia being affected for the first time. In Greece and Estonia, ASF reoccurred after a few years free of ASF outbreaks among domestic (before 2023, the latest outbreaks in Greece and Estonia had occurred in 2020 and 2021, respectively). In contrast, 2023 was the first year since the introduction of the disease in Slovakia in which no outbreaks among domestic pigs were reported in the country.

Four non-EU countries and territories also reported ASF in domestic pigs in 2023 (Bosnia and Herzegovina, Kosovo,[1]* North Macedonia and Serbia), with Bosnia and Herzegovina and Kosovo[1]* being affected for the first time. All countries that reported outbreaks among domestic pigs also notified outbreaks among wild boars.

The domestic pig outbreaks notified through ADIS during 2022 and 2023 were plotted on two maps to analyse the differences in their spatial distribution (Figure 2). The biggest difference between both years is the introduction of the disease in Croatia (with more than 1000 outbreaks reported in a very small area in the eastern part of the country), Bosnia and Herzegovina and Serbia. In the other affected countries and territories, the distribution of outbreaks is more dispersed, with no specific clusters observed in 2023.

In the Baltic States, ASF recurred in Estonia in the summer after 2 years of absence on domestic pig establishments, with two outbreaks in the same region. In Latvia, all outbreaks were in the eastern part of the country, while in Lithuania fewer outbreaks were notified than in 2022 and all concentrated in the area already affected in 2022. In Poland, the outbreaks reported in 2023 were scattered, affecting areas in the centre, east and west of the country, some of them previously unaffected. Germany notified only one outbreak, near the Polish border. In Italy, a small cluster of outbreaks occurred in the north, one outbreak was also notified in Sardinia, and a few outbreaks were notified for the first time in the southern region (complementary information can be found in Sections 3.2.1 and 3.3). Bulgaria notified three outbreaks, two near the border with Romania and one in the centre of the country, while outbreaks in Greece were all on the border with neighbouring

affected countries. Finally, in Romania, the second most affected EU country in 2023, the outbreaks among domestic pigs were scattered across the country.

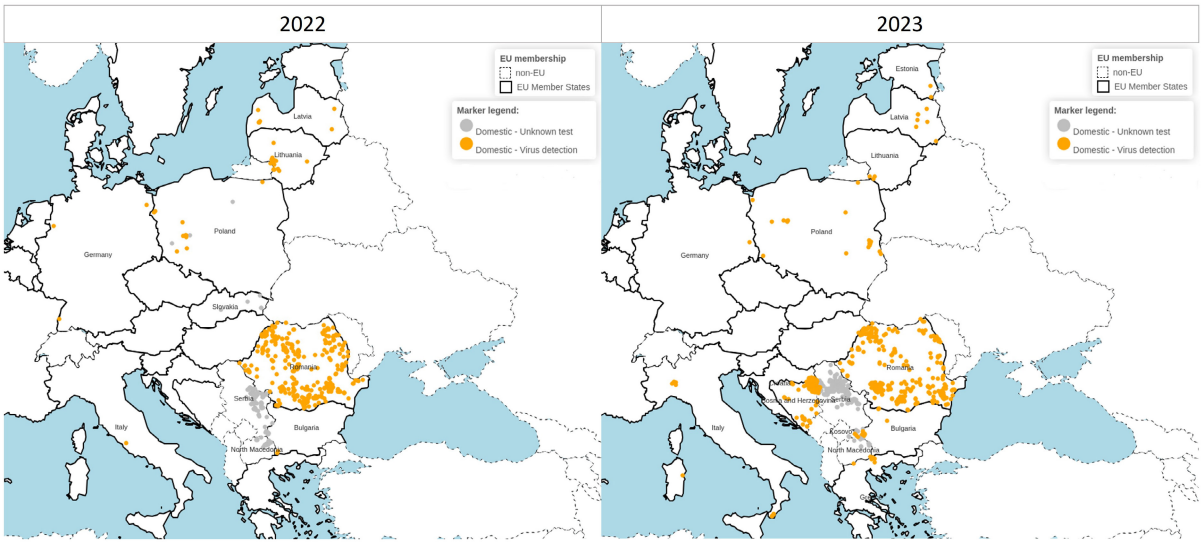

FIGURE 2 Spatial distribution of ASF outbreaks among domestic pigs confirmed in 2022 (left) and 2023 (right). Source: ADIS, accessed 1 February 2024. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map do not imply the 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.

To get a deeper insight into the spatio-temporal evolution of the disease, Figure 3 displays the distribution of ASF in the domestic pig sector, per trimester. For each quarter, the NUTS[6] (Nomenclature of territorial units for statistics) level 3 regions (not available for Bosnia and Herzegovina or Kosovo[1*]) were coloured red, if ASF was notified for the first time ever in the region among domestic pigs; orange, if outbreaks had already been notified and if the latest outbreak had been notified in the previous trimester; grey, if outbreaks had already been notified and if the latest outbreak had been notified before the previous trimester; and white, if no outbreak had ever been notified among domestic pigs.

In 2023, an average of 30 NUTS 3 regions notified outbreaks in domestic pigs per trimester (min. 21, max. 46), with approximately 85% of the affected NUTS 3 regions being in Romania. In comparison with 2022, an average of 34 NUTS 3 regions were affected per trimester (min. 29, max. 37). During 2023, ASF affected 11 NUTS 3 regions that had never been affected before, including 3 in Croatia, 3 in Greece, 3 in Italy, 1 in Germany and 1 in Poland. In Germany, the only outbreak occurred in an urban NUTS 3 region that is an enclave of a previously affected NUTS 3 region. In comparison, in 2022, ASF affected five new NUTS 3 regions, indicating a wider spread to new areas during 2023, although some affected areas were no longer affected.

In the Member States, 98% of the outbreaks notified in 2023 among domestic pigs were in NUTS 3 regions with previous presence of ASF among domestic pigs, either in the previous trimester (89%) or sometime before (9%). Depending on the trimester, between 63% and 96% of the outbreaks were reported in regions where ASF was notified in the previous trimester.

However, these data are highly driven by the two countries with the highest numbers of outbreaks notified. In the newly affected Croatia, ASF was introduced in the second trimester in one region and spread intensively within that region during the third trimester, finally spreading to two new regions (98% of outbreaks notified in Croatia were in NUTS 3 regions affected in the previous trimester). In Romania, 81% of the outbreaks were in regions affected in the previous trimester, suggesting persistent transmission of ASF in the regions affected during 2023 (26 out of the 42 NUTS 3 regions in Romania).

In Italy, 14 outbreaks were in the three newly affected NUTS 3 regions, while only two were reported in the southern region affected in the previous trimester. In Germany, only one outbreak was notified in a NUTS 3 region previously affected by ASF among domestic pigs, while in Greece, the disease recurred after 2 years of absence in the second trimester in three newly affected NUTS 3 regions. In Poland, where ASF had been previously notified in almost half of their NUTS 3 regions, half of the ASF outbreaks were notified in regions historically affected, with spread over two trimesters in one NUTS 3 region, and one new NUTS 3 region got affected in the east without further spread.

In the Member States where ASF outbreaks among domestic pigs had been historically notified in every region of the territory (Baltics States and Bulgaria), all the outbreaks were notified in regions historically affected, but not during the previous trimester. Only a few outbreaks were notified in Latvia and Lithuania in the third trimester in previously affected regions (three and one, respectively). This confirms the sporadic occurrence of ASF in domestic pigs in these Member States, with potentially limited local transmission during the summer months in some of them.

[6]NUTS: is a hierarchical system for dividing up the territory for the collection of European regional statistics in the EU and Pre-Accession countries.

In the non-EU countries and territories, this analysis was not possible in the newly affected Bosnia and Herzegovina and Kosovo[1]* due to the lack of NUTS regionalisation for those. In Serbia, ASF spread to one new region in the second trimester, and five newly affected northern regions in the third trimester, coinciding with the important spread in the neighbouring countries. In North Macedonia, on the other hand, the few outbreaks notified were in the previously affected region, closer to the Bulgarian border.

An important concentration of outbreaks occurred in the area where the borders of Croatia, Bosnia and Herzegovina and Serbia converge, especially during the third trimester, corresponding to the summer months. The presence of a very large number of small establishments with low biosecurity and highly interconnected, favoured the spread of the disease in the region.

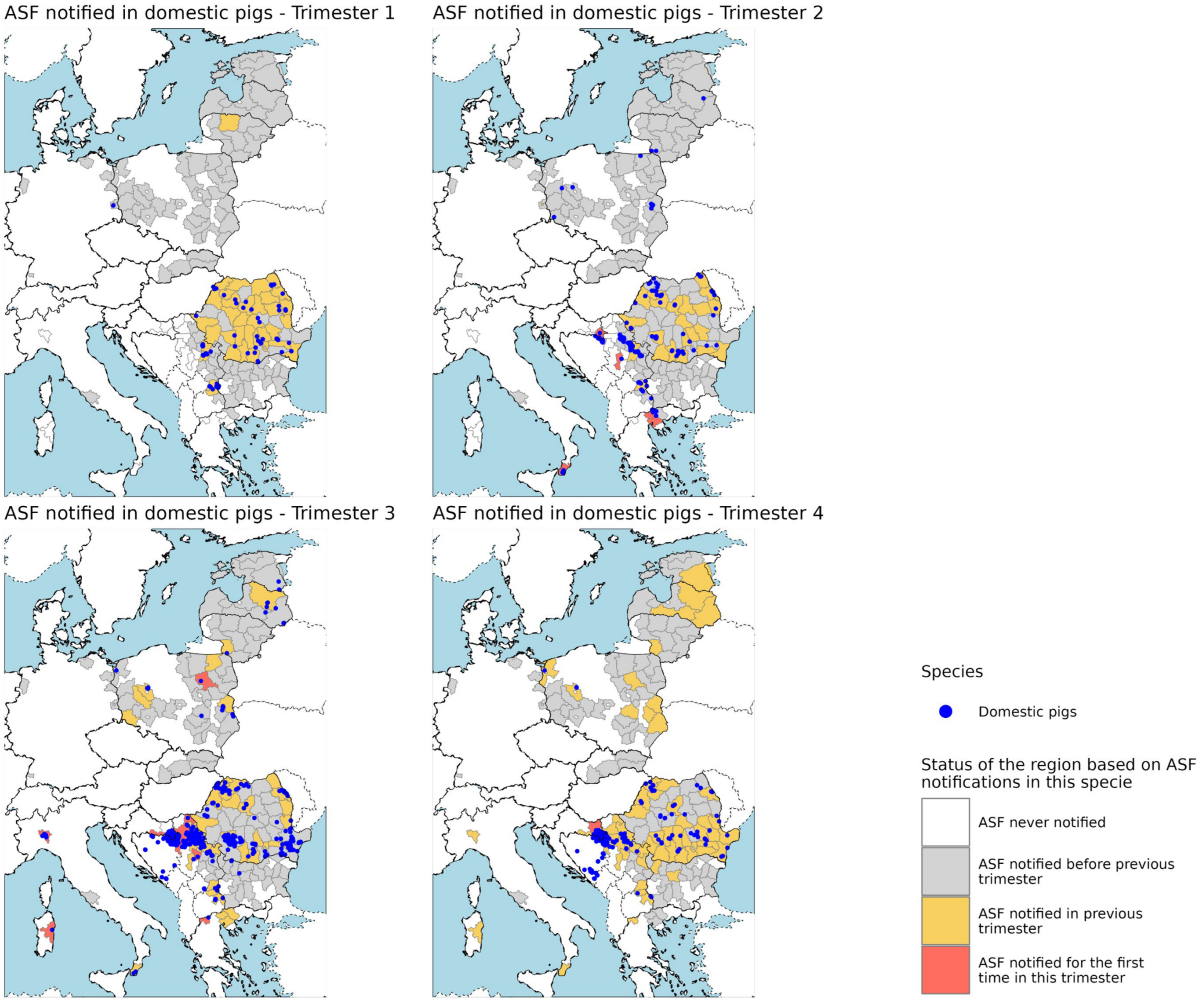

FIGURE 3 Spatio-temporal distribution of ASF outbreaks among domestic pigs in 2023 per quarter per NUTS 3 region. Source: ADIS, accessed 1 February 2024. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map do not imply 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.

3.1.2 | Temporal dynamics among domestic pigs

The temporal dynamics of the numbers of outbreaks per country were investigated for all Member States and divided into two categories based on the number of susceptible pigs reported in the outbreak, considering 100 pigs as the threshold (Figure 4A,B).

The total number of ASF outbreaks occurring in Member States during 2023 was 1929, which is five times the number of outbreaks notified in 2022. This was highly influenced by the introduction and rapid spread of ASF in Croatia, which notified 1124 outbreaks (58% of total EU outbreaks). In addition, Romania also experienced an increase in the number of outbreaks in 2023 (736 compared with 327 outbreaks in 2022). In total, the outbreaks in Croatia and Romania amounted to 96% of the outbreaks in the EU. Poland notified 30 outbreaks (12 of them at establishments with more than 100 pigs), and Italy 16 outbreaks. The rest of the Member States notified fewer than 10 outbreaks during 2023: Latvia (8), Greece (6), Bulgaria (3) and Lithuania (3), Estonia (2) and Germany (1).

In total, 96% of the outbreaks notified by the Member States in 2023 affected establishments with fewer than 100 pigs. This is also relevant when analysing the impact of the disease on the pig sector (see Section 3.5.2). The numbers of outbreaks at establishments with fewer than 100 pigs increased from 348 to 1855 in 2023 (Figure 4A). This was highly influenced by the introduction of the disease in Croatia and the type of establishments affected in that country. The extensive

spread of ASF in Croatia at small pig establishments in the first months after the introduction, repeats the trend observed in Romania in the first years of the epidemic (2018 and 2019), where more than 1000 outbreaks were notified, most of them at small establishments (Figure 4A).

At establishments with more than 100 pigs (Figure 4B), the number of notified outbreaks in the EU almost doubled in comparison with 2022, mostly driven by the 35 outbreaks of this type notified by Croatia. However, the biggest establishments affected (more than 10,000 pigs) were all located in Romania (see Figure 18C and Section 3.5.2).

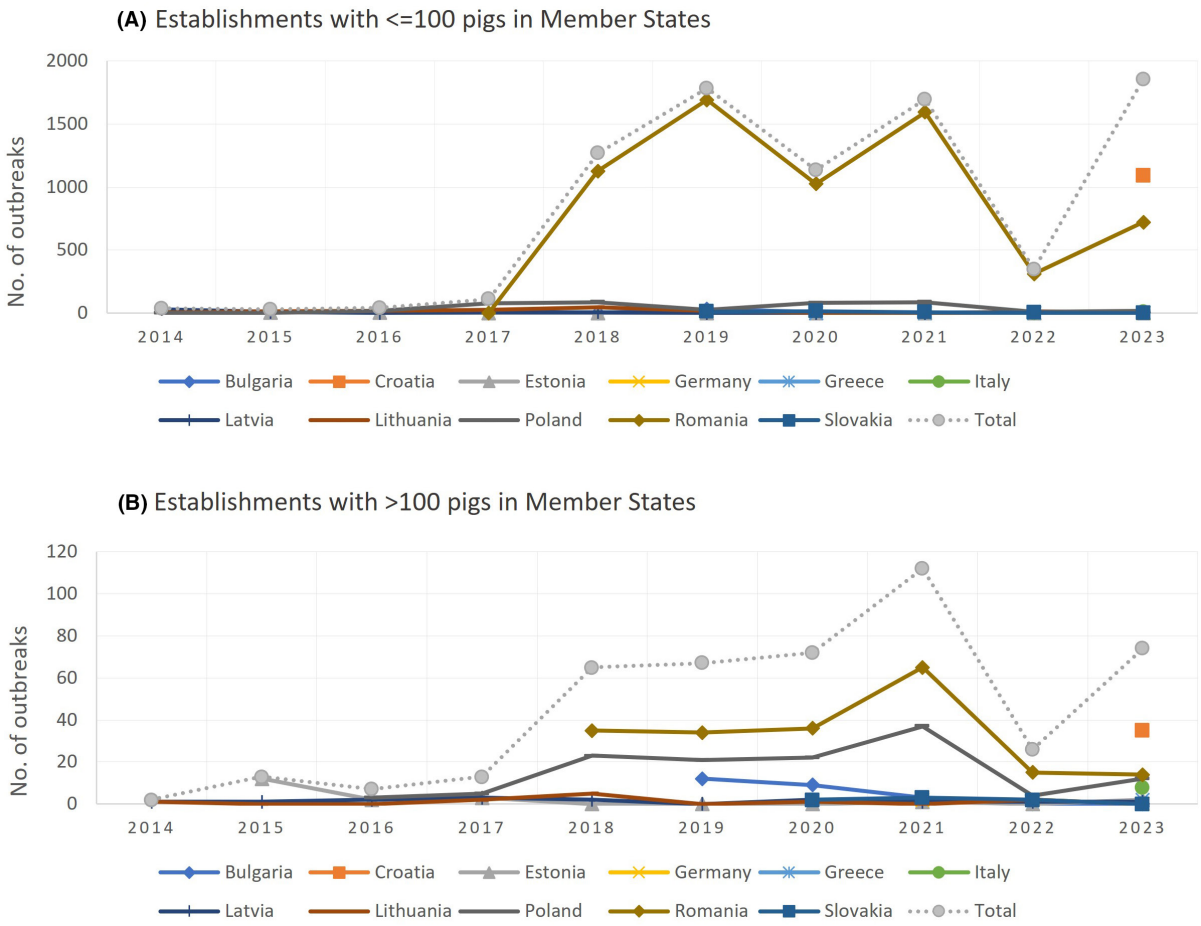

FIGURE 4 Yearly numbers of ASF outbreaks among domestic pigs notified through ADIS by Member State, 2014–2023, for all establishments with fewer than 100 pigs (A), and with more than 100 pigs (B). Note: some countries cannot be seen in the figure due to the small number of outbreaks.

In the non-EU countries and territories included in the report, the total number of outbreaks increased from 137 in 2022 to 2528 in 2023, and the disease also affected two new countries and territories in 2023. Bosnia and Herzegovina (newly affected) and Serbia notified 1511 and 992 outbreaks, respectively, contributing to 99% of the total outbreaks in non-EU countries and territories in 2023. Serbia, affected since 2019, experienced an important increase in 2023, from 107 outbreaks notified in 2022, to 992 outbreaks in 2023. In the non-EU countries and territories, 95% of notified outbreaks occurred at establishments with fewer than 100 pigs. Most of the outbreaks notified at bigger establishments (> 100 pigs) were in Bosnia and Herzegovina (69%). However, the biggest establishments affected were in Serbia (two establishments of more than 10,000 pigs and one of ~7000 pigs) and North Macedonia (9000 pigs), while the biggest establishment affected in Bosnia and Herzegovina had approximately 5000 pigs.

Monthly seasonality among domestic pigs

For domestic pigs, the seasonality in the Member States is described by numbers of outbreaks per month per year (Figure 5A), with a thicker line for 2023 to facilitate comparison. As observed in previous years, in 2023 there was an important peak of outbreaks in the summer months. Specifically, 88% of the outbreaks notified in the Member States occurred between July and October.

In addition, the outbreaks notified in 2023 are shown per month per Member State, differentiated by size of the establishment affected (considering 100 pigs as the threshold, as before). As seen in Figure 5B, the outbreaks in small establishments in Romania and Croatia were clearly concentrated during the summer months with peaks in July and August, respectively. In Croatia, this pattern also applies for the bigger establishments, while in the other Member States, the outbreaks in larger establishments were sporadic and occurred randomly throughout the year (Figure 5C).

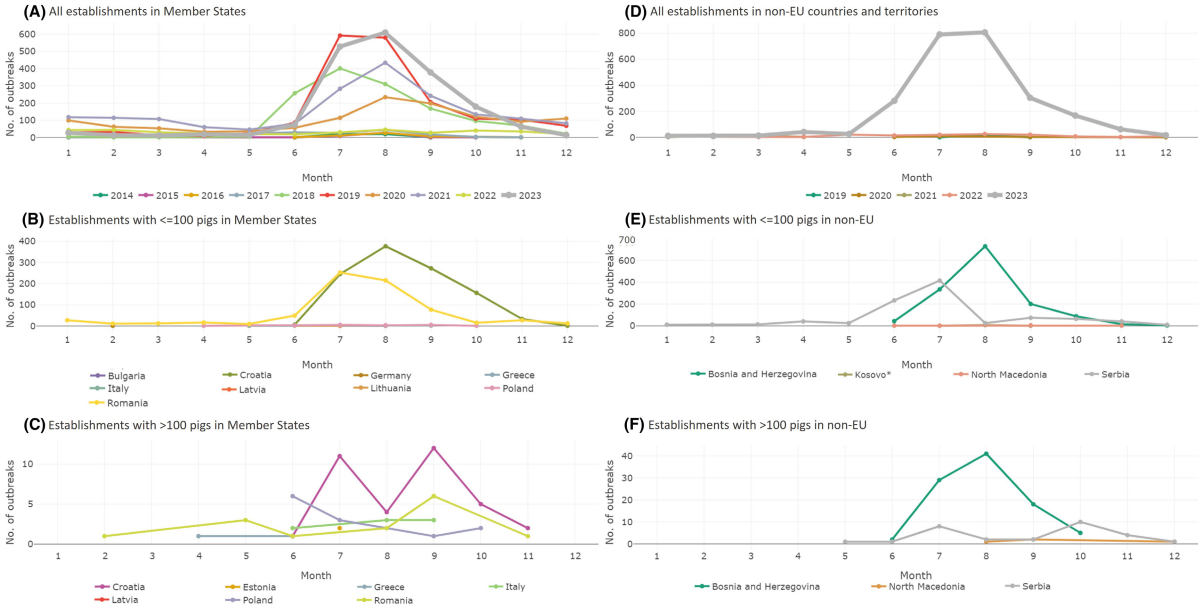

FIGURE 5 Temporal distribution of the numbers of ASF outbreaks at domestic pig establishments in the Member States and non-EU countries and territories by month of confirmation, 2014–2023 (A, D). Temporal distribution of the number of outbreaks at domestic pig establishments with fewer than 100 pigs (B, E) and more than 100 pigs (C, F) per Member State and non-EU country and territory by month of confirmation in 2023. Note: some countries cannot be seen in the figure due to the small number of outbreaks.

The same plots were produced for the non-EU countries and territories, where a clear summer seasonality can be observed in 2023 (Figure 5D), which impedes the visualisation of trends on previous years due to the big differences in total numbers. When splitting by pig establishment size (more or fewer than 100 pigs), there are no big differences, as on both types of establishments, most of the outbreaks (in Serbia and Bosnia and Herzegovina) were notified during July and August (Figure 5E,F). Nevertheless, in October, there was a small peak of outbreaks in larger establishments in Serbia, caused by infection of several establishments epidemiologically connected, located in the same district.

3.1.3 | ASF surveillance in domestic pigs

Surveillance components

Passive surveillance (i.e. the investigation of clinical suspicions, including testing dead pigs and pigs with clinical signs) is considered the basis for the early detection of ASF among domestic pigs. As an additional component to support timely detection, an enhanced passive surveillance can be implemented at establishments, based on the weekly testing of at least two dead post-weaning pigs (older than 60 days) as described by the EFSA AHAW Panel (2021) and as recommended for restricted zones in accordance with the 'Strategic approach to the management of African Swine Fever for the EU' (European Commission, 2020). Additional information on sampling and testing can be found in the ASF guidelines adopted by the European Commission at the end of 2023.[7] Note that for small establishments where fewer than two dead pigs are found per week, it is recommended to test every single pig found dead. Such enhanced passive surveillance[8] is also used by the competent authorities of the EU Member States to comply with the requirements of the EU legislation at domestic pig establishments level prior to grant derogation for authorising animal movements within and from the ASF restricted zones, as prescribed by the European legislation (Regulation (EU) 2023/594[9]). Active surveillance activities targeting apparently healthy pigs are not required by the current ASF Regulation unless considered necessary by the competent authority of the EU Member State concerned.

Via the online questionnaire that was developed for this report, all responding Member States (13/13) reported that passive surveillance (testing of dead pigs and alive pigs with clinical signs) was implemented throughout their whole territories. In three Member States, enhanced passive surveillance was implemented across the whole territory, including not-restricted zones. In the other Member States, this type of surveillance was implemented in the restricted zones, which in some cases corresponded to the whole country. Inside those zones, this surveillance was most frequently implemented

[7]Commission Notice on the guidelines on the prevention, control and eradication of African swine fever in the Union (ASF guidelines) (https://eur-lex.europa.eu/eli/C/2023/1504/oj).

[8]Surveillance by means of testing with pathogen identification tests for ASF virus with negative results each week on at least the first two dead kept porcine animals over the age of 60 days or, in the absence of such dead animals over the age of 60 days, on any dead kept porcine animals after weaning.

[9]Commission Implementing Regulation (EU) 2023/594 of 16 March 2023 laying down special disease control measures for African swine fever and repealing Implementing Regulation (EU) 2021/605. OJ L 79, 17.3.2023, p. 65–150.

(8/13) on all types of establishments, while in some cases (5/13), it was restricted to bigger establishments, commercial or with more than 100 pigs or establishments that move animals.

Regarding active surveillance targeting apparently healthy pigs, various activities were reported by several affected Member States. Testing healthy pigs before movements was reported by six of the Member States, while six Member States reported testing animals at slaughter (in Italy and Estonia, those were pigs that died during transport or at the slaughterhouse, not actual active surveillance). Both activities were mostly performed inside the restricted zones. Less often (3/13), healthy pigs were tested randomly on establishments, and this was done across the whole country by two affected Member States and only in the restricted zone in one Member State.

All the respondent non-EU countries and territories (4) reported performing passive surveillance. Routine testing of two dead pigs per week, testing healthy pigs before movement and testing pigs at slaughter were applied by three of the respondents, while the testing of healthy pigs randomly on establishments was applied in all of them. More detail on the surveillance activities performed by the countries can be found in Tables A.1, A.2 in Appendix A.

In total, 11 countries (10 Member States and one non-EU country) submitted laboratory data in 2023 related to test results from domestic pigs, two more than the previous year. In the Member States, 615,531 samples originating from domestic pigs were analysed for ASF in 2023, compared with 618,809 samples in 2022. Approximately half of the samples analysed in the Member States (309,535 samples) were tested as part of passive surveillance[10] and the other half (305,996 samples) were surveillance efforts targeting apparently healthy pigs (active surveillance[11]). Since the introduction of ASF genotype II to the EU in 2014, 2023 was the first year in which the number of samples analysed as part of the passive surveillance in affected countries in Europe exceeded the number of samples analysed as part of the active surveillance (Figure 6).

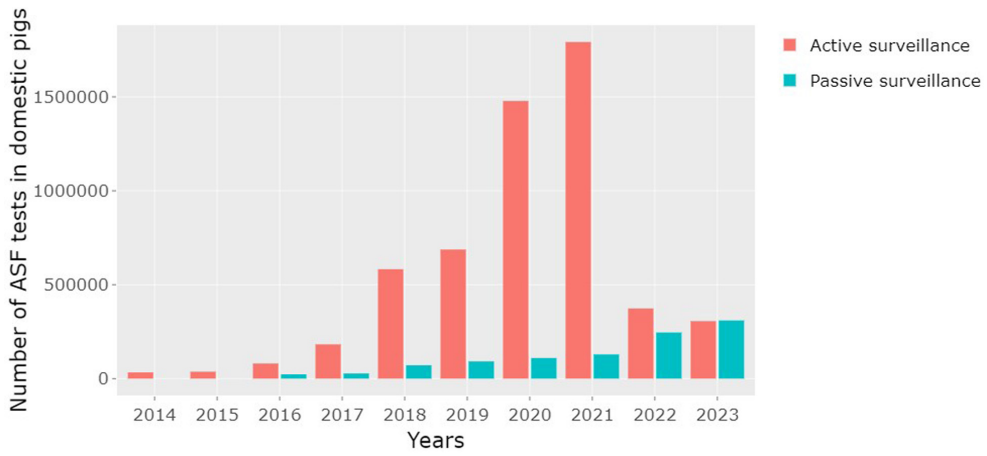

FIGURE 6 Number of domestic pig samples analysed for ASF by reporting Member States per year, differentiating active from passive surveillance components.

According to the Member States' responses to the questionnaire (which comprise information on 1930 outbreaks), 1808 outbreaks were detected through passive surveillance based on testing clinical suspicions (94%), whereas 54 outbreaks (3%) were detected through enhanced passive surveillance based on weekly testing of at least two dead pigs. All 6 outbreaks occurring at establishments with more than 10,000 pigs were detected through enhanced passive surveillance, as well as 5 of the 12 outbreaks at establishments with 1000–10,000 pigs. Sixty-five outbreaks (3%) were detected as part of active disease surveillance, more specifically by sampling pigs in relation to tracing from affected establishments. No outbreaks were reported to have been detected through active surveillance targeting healthy pigs at slaughter, before movement or randomly on establishments.

In the non-EU countries and territories, based on the four responses to the questionnaire, most of the outbreaks were detected through passive surveillance, approximately 10% by active surveillance, and very few (three) through enhanced passive surveillance activities (on establishments ranging from 10,000 to 20,000 pigs).

Surveillance results

In the Member States submitting data to EFSA, 96% of samples originating from domestic pigs during 2023 were analysed only by PCR (590,118 samples), whereas ~3.5% of the samples were analysed only by ELISA tests (21,564 samples) and 0.6% of samples (3588) were tested by PCR and ELISA in parallel. These proportions are very similar to the previous year: in 2022, 96% of samples were analysed by PCR versus 6% by ELISA. Other tests, such as the indirect immune-peroxidase test (IPT), direct fluorescence antibody test and virus isolation were used on a very small number of samples (952 samples, 0.2% of tests). Most serological tests in domestic pigs were performed as part of active surveillance activities (78% tests).

[10]'Passive surveillance' included the samples reported to the DCF as 'alive symptomatic', 'dead (either symptomatic or asymptomatic)', 'culled animals' and 'hunted symptomatic' (for wild boar).

[11]'Active surveillance' included the samples reported to the DCF as 'alive' or 'alive non-symptomatic', 'slaughtered', 'hunted' and 'hunted non-symptomatic' (for wild boar).

Serological results were reported by most of the Member States affected by ASF in domestic pigs, but their use was rather sporadic, except for Romania (77% of the serological tests conducted in the Member States), followed by Poland (14%) and Lithuania (7%).

Among affected non-EU countries and territories, North Macedonia was the only country making available to EFSA its laboratory data for domestic pigs in 2023. In 2023, 3015 samples were analysed, 50% less than in 2022, coinciding with a decrease in the number of outbreaks in the country (from 30 outbreaks in 2022, to 15 in 2023). Overall, 2930 pig samples were analysed for ASFv by PCR (of which 35% and 65% derived from active and passive surveillance[12] activities, respectively) and 85 by serological tests (all of them were from active surveillance activities). No seropositive animals were found, while 0.1 and 2.8% of the PCR tests were positive in the active and passive surveillance components, respectively (Table 2).

[12]'Passive surveillance' included the samples reported to the DCF as 'alive symptomatic', 'dead (either symptomatic or asymptomatic)', 'culled animals' and 'hunted symptomatic' (for wild boar).

TABLE 2 Summary of the ASF surveillance results per surveillance component for domestic pigs, as reported by the affected countries. (–) represents no data submitted.

			Sample level[a]					
			Serological tests[b]		PCR tests			
	Surveillance component	Country	Tests	% POS	Tests	% POS	Establishments sampled[c]	Outbreaks[d]
EU Member States	Active surveillance (alive asymptomatic, including slaughtered pigs)	Czechia	6	0	18	0	2	
		Germany	–		–			
		Estonia	30	0	910	0		
		Hungary	–		108,938	0		
		Italy	–		0	0		
		Lithuania	–		1	0	1	
		Latvia	–		–			
		Poland	3032	0.5	170,488	0.2		
		Romania	16,670	0.01	3046	1.1	522	
		Slovakia	190	0	5806	0	290	
	Active surveillance total		19,928	0.08	289,207	0.1	815	
	Passive or enhanced passive surveillance (dead, alive symptomatic or culled pigs)	Bulgaria	–		–			3
		Czechia	–		2886	0	225	0
		Germany	–		–			1
		Estonia	155	0.6	2658	0.7		2
		Greece	–		–			6
		Croatia	–		–			1124
		Hungary	–		13,685	0		0
		Italy	–		12,732	0.4	2816	16
		Lithuania	1862	0	3358	0.4	700	3
		Latvia	21	38.1	3174	0.8	62	8
		Poland	440	0.9	221,333	0.2		30
		Romania	2996	1.4	44,652	3.2	6135	736
		Sweden	–		61	0		0
		Slovakia	11	0	182	0	39	0
	Passive surveillance total		5485	1	304,721	0.6	9977	–
	Total surveillance		25,413	0.3	593,928	0.4	10,792	
Non-EU countries and territories	Active surveillance total	North Macedonia	85	0	1017	0.1	0	–
	Passive surveillance total	North Macedonia	–		1913	2.8	0	16
	Total surveillance		85	0	2930	1.9	0	

Note: The proportions of positive test results do not correspond to the prevalence since the sampling was not necessarily done randomly.

[a]Sample data from countries and territories reported to the Data Collection Framework.

[b]Serological tests include samples analysed by ELISA and/or confirmatory tests such as IPT and IB. For analysis purposes, the results of confirmatory tests prevail over ELISA results.

[c]Sample data were aggregated at the establishment/subunit level (e.g. farms, pastures, slaughterhouse). When subunit_Id was not submitted in the laboratory data or quality of data were not enough (at least 90% samples provided subunit ID) for aggregating data at establishment/subunit level, NA appears in the table.

[d]Outbreak data as reported through ADIS. As the detection method cannot be differentiated, the total number of outbreaks were included only in the lower part of the table to avoid duplication.

HIGHLIGHTS FROM THE DOMESTIC PIG SECTION

In 2023, among the EU Member States ASF was notified in domestic pigs for the first time in Croatia, and of the non-EU countries and territories the disease was notified for the first time in Bosnia and Herzegovina and Kosovo.[1*]

The number of notified outbreaks of ASF among domestic pigs in the Member States was five times higher than in 2022, reaching a similar magnitude to that in 2019. This increase was highly driven by the ASF emergence in Croatia (1124 outbreaks) and the resurgence in Romania (736). These two countries accounted for 96% of the EU outbreaks.

In the rest of the EU, the outbreaks among domestic pigs were sporadic: 30 in Poland, 16 in Italy and fewer than 10 in the other 6 affected Member States.

Across the EU, ASF was notified in 11 NUTS 3 regions that had never been affected before (in comparison to 5 in 2022), located in Croatia, Greece, Germany, Italy and Poland, indicating a wider spread to new areas.

Most of the outbreaks (96%) occurred on small establishments with fewer than 100 pigs, and all six outbreaks occurring on establishments with more than 10,000 pigs were in Romania.

In the non-EU countries and territories, a very important increase was observed in the number of notified outbreaks among domestic pigs (18 times more). This was driven by the emergence and spread in Bosnia and Herzegovina and the sharp increase in incidence in Serbia (nine times more outbreaks than in 2022). Together they accounted for 99% of the outbreaks notified in domestic pigs during 2023 among the non-EU countries and territories included in this report.

In the Member States, 94% of the outbreaks among domestic pigs were detected through passive surveillance based on clinical suspicion, 3% were identified through contact tracing from affected establishments and 3% (54 outbreaks) were found as the result of enhanced passive surveillance based on the weekly testing of at least two dead pigs. All six outbreaks that occurred at establishments with more than 10,000 pigs in the EU and five of the 12 outbreaks at establishments with 1000–10,000 pigs were detected through enhanced passive surveillance. No outbreaks were detected through active surveillance targeting healthy pigs at slaughter, before movement or randomly selected at establishments.

A clear summer seasonality of ASF in domestic pigs was observed, with 88% of the outbreaks having been reported between July and October. This seasonality was particularly clear in Croatia and Romania for small-scale establishments of fewer than 100 pigs.

3.2 | Disease epidemiology and ASF surveillance in wild boar

3.2.1 | Spatial distribution among wild boar

During 2023, ASF outbreaks among wild boar were notified by 14 Member States (Bulgaria, Croatia, Czechia, Estonia, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Romania, Slovakia and Sweden), and 4 non-EU countries and territories (Bosnia and Herzegovina, Kosovo,[1*] North Macedonia and Serbia). Of the Member States, Croatia and Sweden notified the disease for the first time, while Greece notified for the first time in wild boar (previously, outbreaks of ASF had been notified only among domestic pigs). Bosnia and Herzegovina and Kosovo[1*] notified for the first time from non-EU countries and territories.

Among these 14 affected Member States, 4 (Czechia, Hungary, Slovakia and Sweden) notified ASF only in wild boar, while all non-EU countries and territories notified outbreaks among both domestic pigs and wild boars.

The ASF outbreaks among wild boar notified through ADIS during 2022 and 2023 were plotted on parallel maps to analyse the spatial distribution (Figure 7). When comparing both years, no big changes were observed in the distribution of the wild boar outbreaks in northern Europe except for the new outbreaks notified in Sweden. Outbreaks continued to be reported across Latvia and Lithuania and in the north and east of Estonia. In Poland, the location of outbreaks was relatively stable, whereas in Germany the situation improved as the outbreaks were only notified in the central eastern (bordering Poland) and the rest of the country did not notify any outbreaks during 2023. In Czechia and Greece, there were sporadic outbreaks, as well as in Croatia, in contrast to the situation for domestic pigs previously mentioned. In Hungary and Slovakia, the disease affected smaller areas to the previous year with apparently lower number of outbreaks. In Italy, the disease spread in the northern affected region, and outbreaks were reported in Lazio (previously affected) and in two new regions further south.

In the non-EU neighbouring countries and territories, ASF spread to new areas in comparison with 2022 as Bosnia and Herzegovina and north-western Serbia notified outbreaks among wild boar.

Where available, the type of test results used for outbreak confirmation is presented on the maps (Figure 7). Most wild boar outbreaks in the Member States were confirmed by virus detection (56%), while 21% of outbreaks were notified as confirmed by serological tests and no test was reported for the remaining 23%. The distribution of PCR-positive versus antibody-positive outbreaks in a country or region reflects the epidemiological situation. In some countries, there is a difference in the spatial distribution of outbreaks identified by virus detection vs antibody detection. For example, in

Bulgaria, most of the wild boar outbreaks notified through ADIS were confirmed by serological tests, while in Italy and Latvia all samples taken during 2023 were tested by PCR. The seven positive serological results detected in hunted wild boar in Latvia corresponded to samples collected at the end of 2022 and confirmed in early January 2023. In the rest of the Member States reporting the diagnostic method through ADIS, the distribution of seropositive outbreaks overlaps with those detected by PCR.

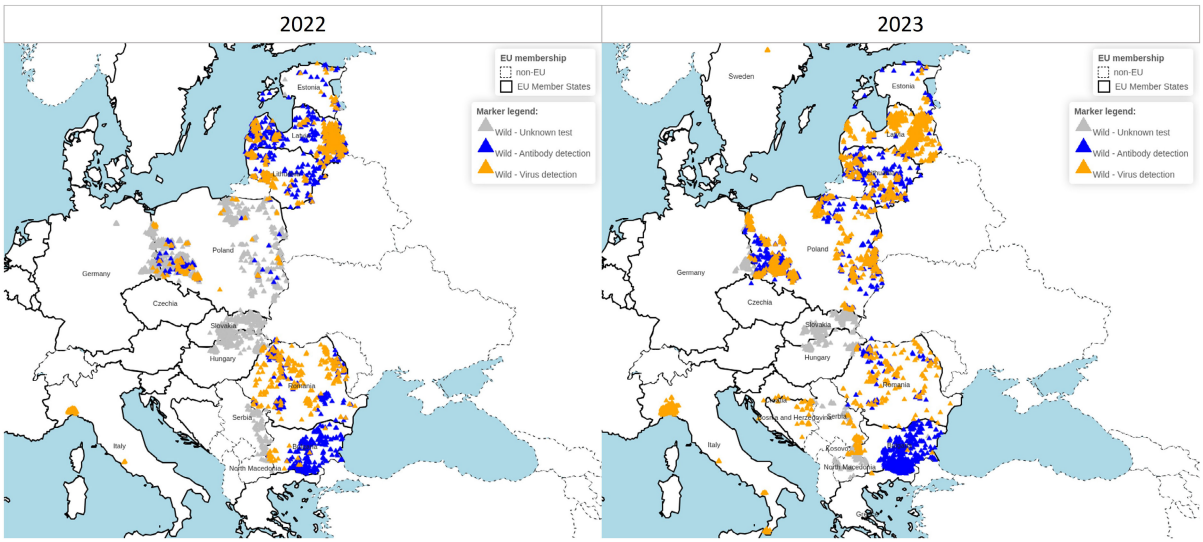

FIGURE 7 Spatial distribution of ASF outbreaks among wild boar confirmed in 2022 (left) and 2023 (right). Source: ADIS, accessed 1 February 2024. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map do not imply the expression 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.

The spatio-temporal dynamics of ASF among wild boar in 2023 are presented in Figure 8, following the same principles as for domestic pigs (Section 3.1.1). During 2023, an average of 104 NUTS 3 regions (min. 92, max. 113) notified outbreaks in wild boar per trimester, very similar to 2022 (average 103, min. 82, max. 124). This confirms the wider distribution of ASF in wild boar in comparison with domestic pigs (average of 30 affected NUTS 3 per trimester). In the Member States, 98% of the outbreaks notified in 2023 among wild boars were in NUTS 3 regions affected in the past, either in the previous trimester (91%) or sometime before (7%). Depending on the trimester, this percentage slightly varied from 94% to 99% in the third trimester due to the introduction of the disease into new regions. Only 2% of the wild boar outbreaks notified in the Member States during 2023 occurred in NUTS 3 regions not previously affected by the disease, and 17 new NUTS 3 regions became newly infected (in comparison with 14 in 2022). The new NUTS 3 regions affected were in countries affected for the first time; Croatia (4) and Sweden (1); and in previously affected countries where the disease occurred in new NUTS 3 regions: Italy (4), Germany (one small NUTS 3 region included in a previously affected region), Greece (3), Poland (3) and Slovakia (1).

Although 57% of the ASF outbreaks among wild boar were notified during the winter months (first and fourth trimester), most of the NUTS 3 regions that became affected for the first time were reported during the second and third trimester of the year (70%).

In the non-EU countries and territories for which this analysis was possible (Serbia and North Macedonia), ASF spread affecting a few wild boars in new regions of North Macedonia (4) and Serbia (two new regions in the north). As observed in Figure 8, the spread to newly affected territories started in the second trimester and continued throughout the year.

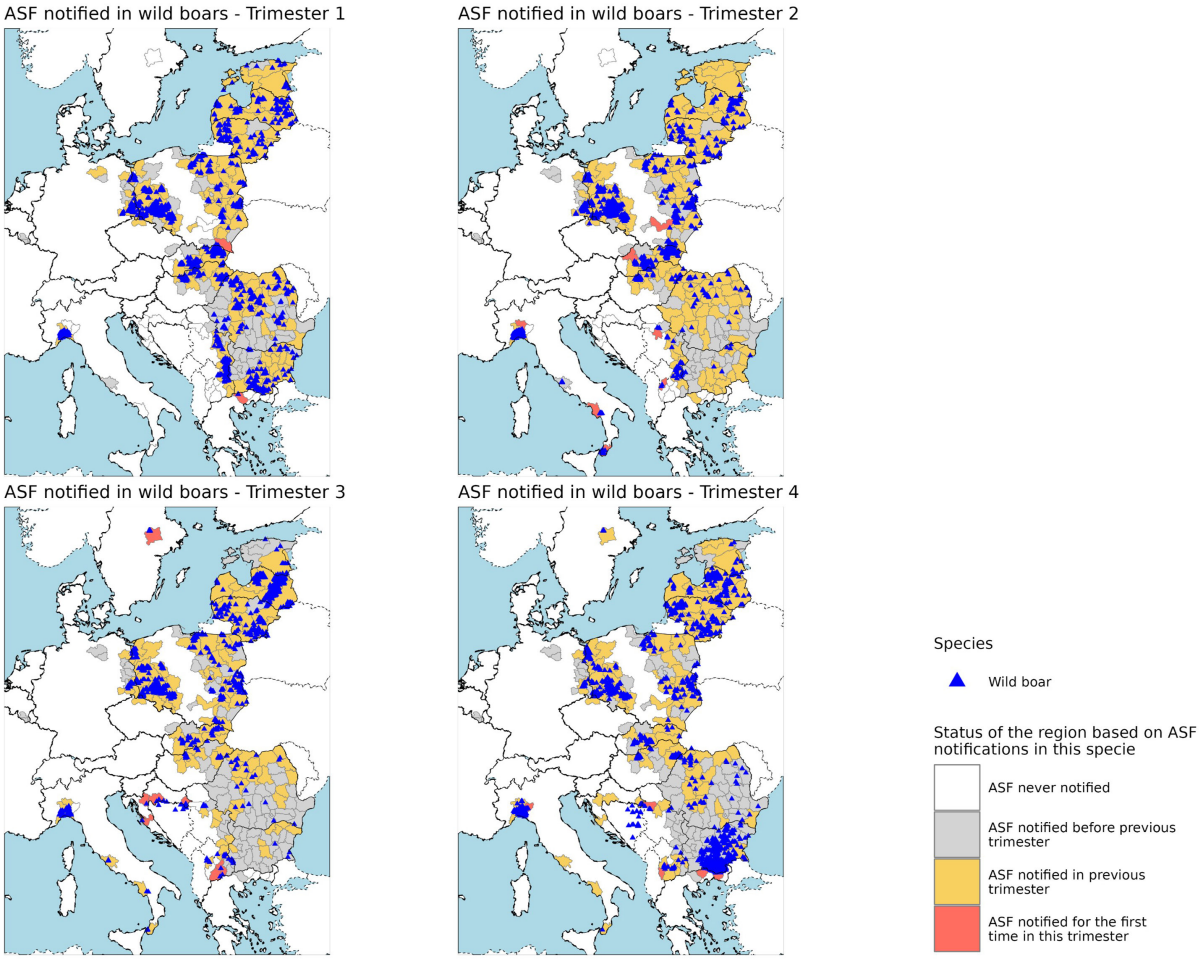

FIGURE 8 Spatio-temporal distribution of ASF outbreaks among wild boar in 2023 per trimester per NUTS 3 region. Source: ADIS, accessed 1 February 2024. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map do not imply 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.

3.2.2 | Temporal dynamics among wild boar

Despite the introduction into new countries, the number of wild boar outbreaks notified in the EU in 2023 only increased by 10% in comparison with 2022 (7855 vs. 7139 outbreaks) (Figure 9). The number of outbreaks notified in 2023 was still considerably lower than the number of outbreaks notified in 2020 and 2021. At the EU level, a peak of notified outbreaks was consistently observed during winter (Figure 9, orange line). However, the seasonality analysis (Figure 11) showed differences between countries.

Among Member States, Poland notified the highest number of ASF outbreaks among wild boar (2686 outbreaks, accounting for 34% of outbreaks in the EU), followed by Italy (1051) and Germany (888). In comparison with 2022, an increase in the number of notified outbreaks was observed in Czechia (from one outbreak in December 2022 to 56 in 2023), Italy (+783), Bulgaria (+348), Lithuania (+129) and Poland (+573). In contrast, the number of outbreaks notified was reduced in Germany (–712), Romania (–161), Latvia (–183), Hungary (–165) and Slovakia (–26). In Estonia, the number of outbreaks remained stable (53 in both years).

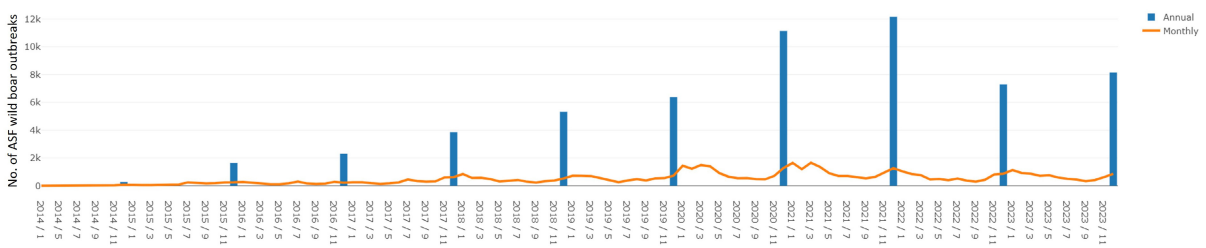

FIGURE 9 Monthly (orange line) and annual (blue bars) numbers of ASF wild boar outbreaks notified by the Member States through the Animal Diseases Information System, 2014–2023.

In the non-EU countries and territories, the number of outbreaks among wild boar in 2023 almost doubled compared with the previous year (293 vs. 156). Serbia was the non-EU country with the highest number of ASF outbreaks among wild boar (Figure 8), with 213 outbreaks reported across the territory, experiencing an increase of 46% in comparison with 2022. It is followed by North Macedonia with 47 outbreaks located mostly in eastern part of the country, Bosnia and Herzegovina (29) and Kosovo[1]* (4).

The proportion of positive samples from wild boar tested by PCR (blue) or Ab ELISA (in red) (here called ELISA) as part of passive surveillance activities (found dead or hunted with clinical signs) is shown in Figure 10.[13] This analysis was only performed for the affected countries that had been reporting data to the DCF for more than three consecutive years (therefore excluding Bulgaria, Croatia, Czechia, Greece, Italy and Sweden).

In none of the analysed countries, a clear trend was observed for the proportion of positive samples by ELISA, while some patterns emerged for the proportion of positive samples by PCR. In Germany and Slovakia, a decreasing trend was observed in 2023, as compared with 2022. In Hungary, the temporal pattern of the PCR positivity rates in 2023 was similar to 2022, confirming the improved situation that was first observed in 2022. In the rest of the countries, the variation within years was larger than between years.

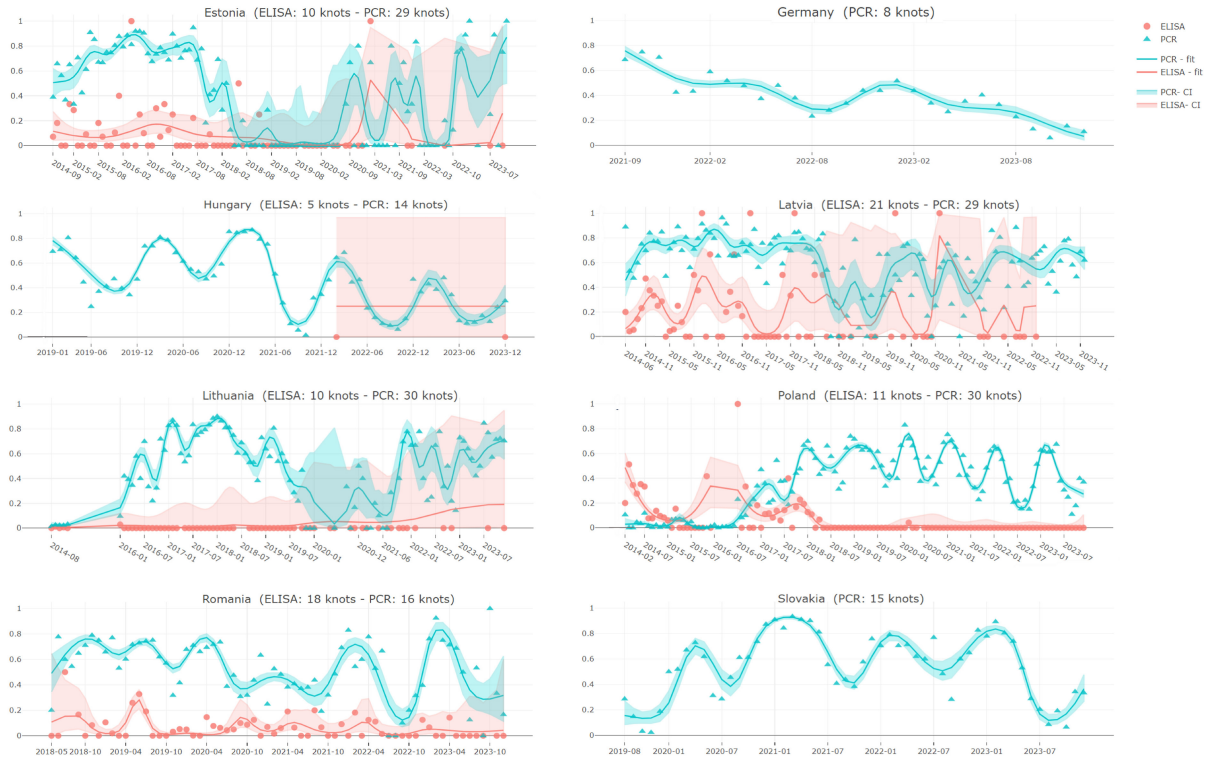

FIGURE 10 Proportion of ASF-positive samples over the tested samples (by Ab ELISA and PCR) from wild boar during passive surveillance activities in the ASF-affected countries. Note: Only ASF-affected countries that had reported laboratory results to EFSA for more than three consecutive years were included in the analysis.

Monthly seasonality among wild boar

As done in the time profiles, the seasonality of PCR-positive wild boar found dead was calculated and plotted only for the countries affected that had been reporting data to the DCF for more than three consecutive years. Figure 11 shows the proportions of PCR-positive samples from wild boar tested through passive surveillance activities.

In most of the countries, 2023 data (green line) follow the historical trend previously reported (blue line) suggesting relevant factors within the country which are stable over the years, potentially related to ecology, hunting practices, disease management and surveillance strategies. A marked seasonality with a peak in winter and the lowest proportions in summer was still observed in Poland, Slovakia and Hungary in 2023. In Estonia, the low number of dead wild boar tested in 2023 hampers the interpretation of results, while no clear trends are observed in the other Member States. The reasons behind this winter seasonality have been observed and discussed in previous EFSA reports (EFSA, 2020, 2021, 2022c, 2023b). Some of the previously mentioned factors are related to the wild boar ecology and management strategies (e.g. carcass search efficiency), as well as the longer survival of the carcass and the virus in the environment.

[13]The trends for the active surveillance samples (mainly hunted animals) were also analysed, but as all the countries showed a plain graph with values near or at zero, the graphs are not included in the report.

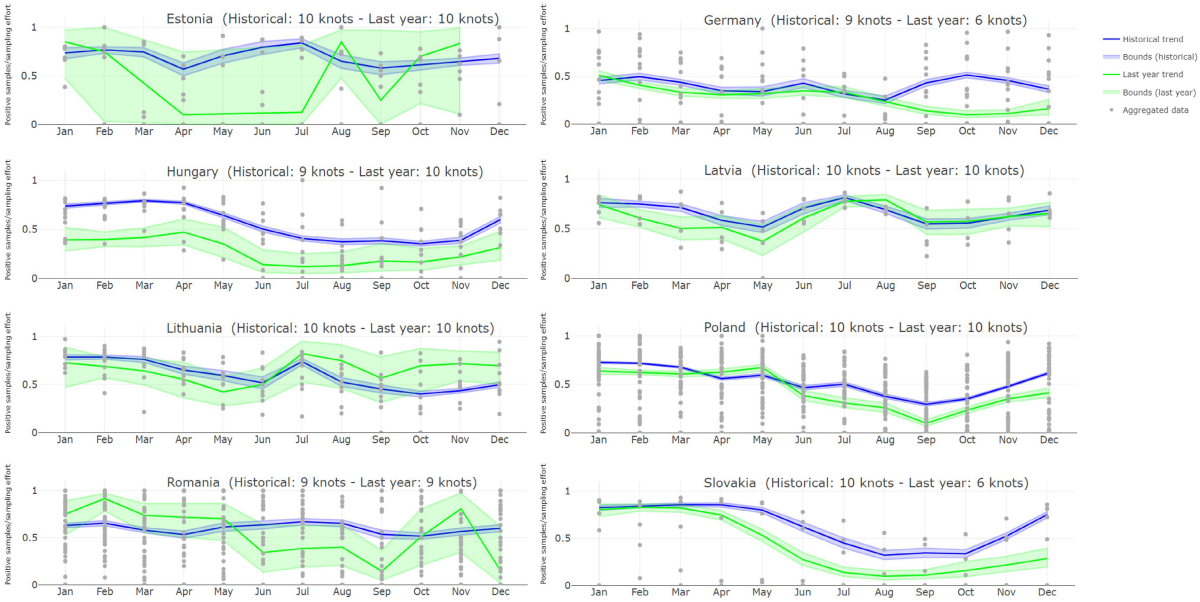

FIGURE 11 Average proportion of wild boar samples testing positive to ASF by PCR, aggregated by calendar month and NUTS 3 region, for wild boar found dead (passive surveillance) in the reporting countries with more than three years of data. Blue indicates historical data and green last year's data.

3.2.3 | Secondary outbreaks in wild boar

The purpose of this investigation was to evaluate, whether there was a development in the numbers of potential secondary outbreaks in wild boar that could be attributed to a single source, and to compare 2023 with the first year of the epidemic and 2022. Although this potential number of secondary outbreaks (means of bootstraps calculated with a network analysis) is not to be interpreted as the true reproduction number, it can be considered as a proxy for the extent of the spread in the evaluated period, and it therefore allows comparison between periods in the epidemic in the same country. This can be useful to help understand the trend of the epidemic, i.e. whether it is still in the expanding phase, or if it is rather fading out (EFSA, 2021).

Newly affected countries and countries with very few notified outbreaks were not included in this analysis, as not enough data are available to perform any comparison over time in these countries. The results of the bootstrap were plotted in Figure 12, and further details are presented in Table B.1 of Appendix B.

In Figure 12, the number of potential secondary outbreaks in wild boar showed an increase in several countries in comparison with 2022. However, when the results of both years were plotted and the overlapping area was analysed (column 'Overlapping coefficients for previous and current reporting period' in Table B.1), this increase was only significant in Germany and Poland, while a significant decrease was observed in Hungary and North Macedonia (non-EU).

It should be noted that a change in the number of secondary outbreaks could be related to the level of the surveillance effort in the country, as the higher the number of carcasses found in a smaller area, the higher the result of this analysis. This fact becomes relevant when considering the efforts made in Germany to systematically search for carcasses with trained dogs and drones, plus the important reduction in the affected area observed in 2023 (see Section 4 and Table A.3 in Appendix A for further information on this).

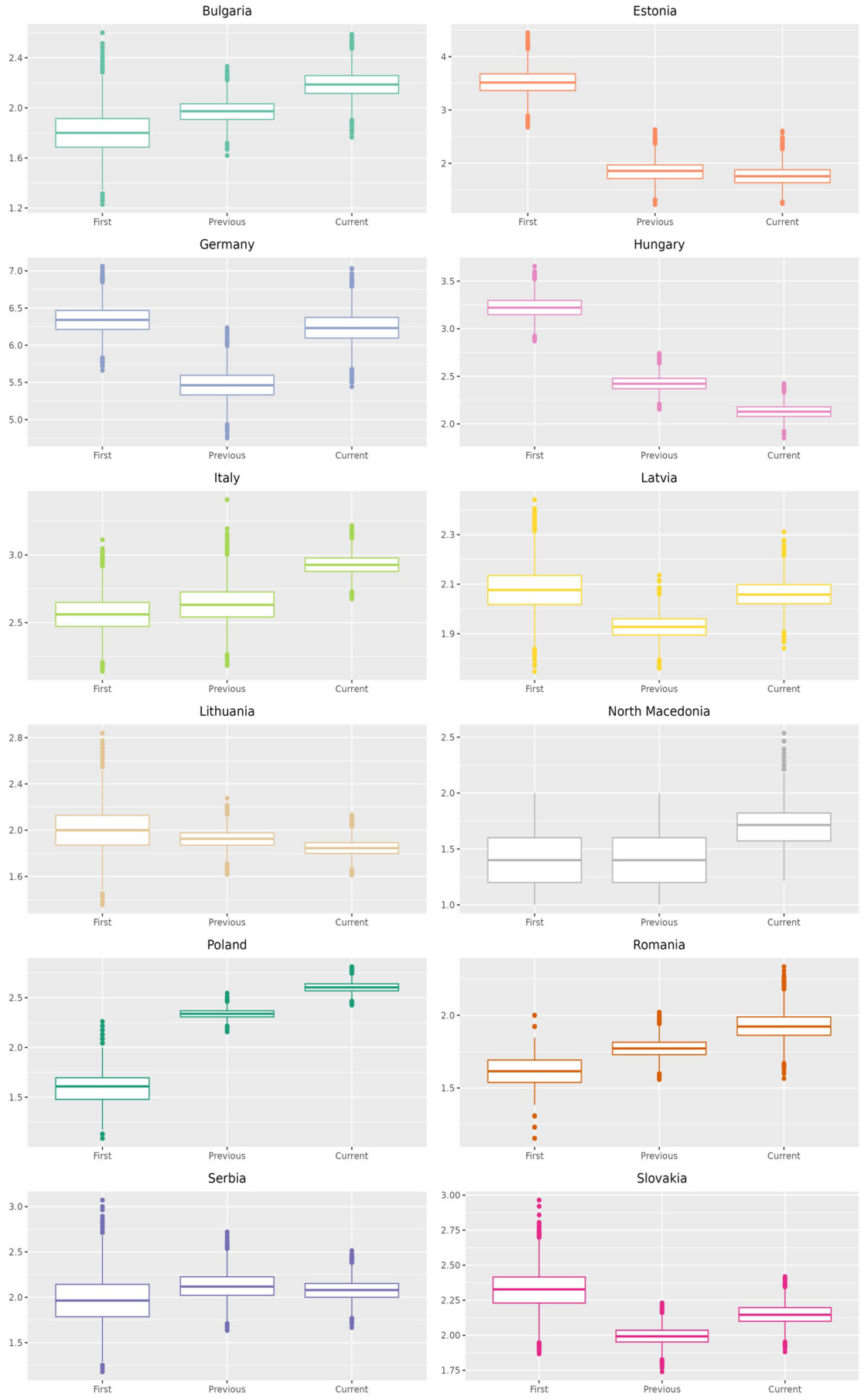

FIGURE 12 Bootstrapped number of ASF secondary outbreaks in wild boar per affected country comparing the whole reporting period since ASF was first detected, the previous year (2022) and the current reporting period (2023). Note: the boxes represent the quartiles (25, 50 and 75%). Note: Croatia, Czechia, Greece, Sweden, Bosnia and Herzegovina, and Kosovo[1*] were not included in the analysis as they had only recently become infected or they notified very few outbreaks so no comparison was possible.

3.2.4 | ASF surveillance in wild boar populations

In the questionnaire sent out for this report, all responding affected Member States (13/13) reported that they performed passive surveillance of wild boar found dead across the whole country, and tested wild boar killed by vehicle collisions across the country, except Sweden, which only tested those animals in the restricted zones. However, some differences were observed in relation to the testing of hunted wild boar. Ten Member States reported testing all hunted wild boar only in restricted zones and their surroundings. In three of these Member States (Latvia, Lithuania and Romania), all parts of the country were in restricted zones II or III. In Latvia, a derogation for self-consumption wild boar has been applied (Art 52.3 of the REG. 2023/594) since May 2023. Since then, approximately 72% of hunted wild boar are tested by PCR. Two other Member States (Czechia and Germany) reported that they tested all hunted wild boar in the restricted zones and their surroundings, but also a sample of hunted wild boar in the rest of the country. Finally, Estonia tested a selection of hunted wild boar, including all the wild boar hunted from counties where ASF had tested positive by PCR in previous years, those next to Latvian positive regions and those to be sent to meat plants for processing.

In half of the respondents (6), all hunted wild boar in restricted zones were analysed for ASF, while in others, a variable percentage from 25% to 72% of hunted wild boar were analysed. Further, differences in the proportion of hunted wild boar tested were observed in the answers from the non-EU countries and territories (4), varying from 1% to 100% of the whole territory, to 100% of the restricted zones. For more detail, see Table A.3 in Appendix A.

The spatial distribution of the number of wild boar samples collected by NUTS 3 region, for hunted and found-dead wild boar, is presented in Figure 13A,B, respectively. The NUTS 3 regions where at least one sample of wild boar tested positive in 2023 are highlighted with red borders. As observed in a previous report (EFSA, 2023b), the most intense surveillance activities were noted for hunted wild boar (represented in dark blue in Figure 13A) in affected regions and their bordering areas (e.g. Baltic States, Poland), and in areas previously affected areas that had managed to eliminate the disease (e.g. north-eastern Germany) in order to demonstrate absence of ASFv circulation. It is worth noting that a very large majority of NUTS 3 regions in Czechia, Germany, Italy and South Sweden had at least one wild boar tested in 2023, including numerous disease-free regions. The comparison of Figure 13C,D is a clear visual illustration that the prevalence of ASF in found-dead animals (> 10% in most affected NUTS 3 regions in Europe) is much higher than among hunted wild boar (< 1% in most affected NUTS 3 regions in Europe).

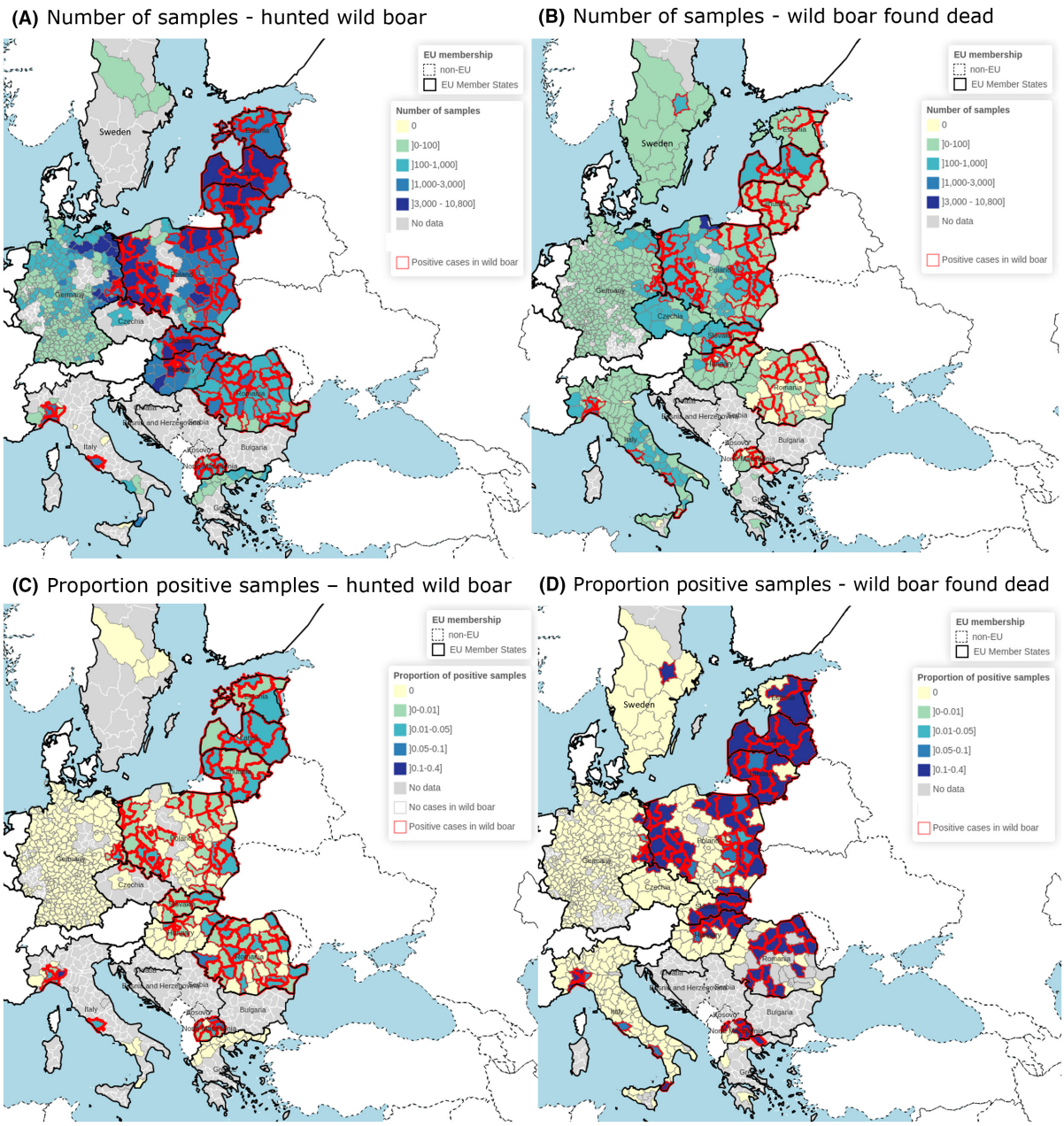

FIGURE 13 Spatial distribution of the number of samples tested for ASF from wild boar hunted (A) and found dead (B); and the proportion of positive samples from hunted wild boar (C) and found dead (D) by NUTS 3 regions. If positive samples were detected for that category of wild boar, the borders of that region are highlighted in red. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map 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.

In total, 13 countries (12 Member States and one non-EU country) submitted laboratory data related to test results from wild boar (Table 3). In the Member States, 448,643 samples were analysed in 2023. Compared with 2022, this is a decrease of 44,693 samples, although the number of reporting countries increased by two in 2023. As observed in Figure 14, 92% of the samples analysed in the Member States came from hunted wild boar, followed by wild boar found dead[14] (4.8%) and road kills[15] (3.2%). This is very similar to 2022, when the hunted samples represented 93%, followed by found dead (4.2%) and road kills (2.9%).

[14]This category includes the wild boar found dead, alive symptomatic, culled and hunted symptomatic.

[15]Wild boar samples were classified as road-killed and reported as such by the countries, referring to wild boar found in close proximity to roads or railways.

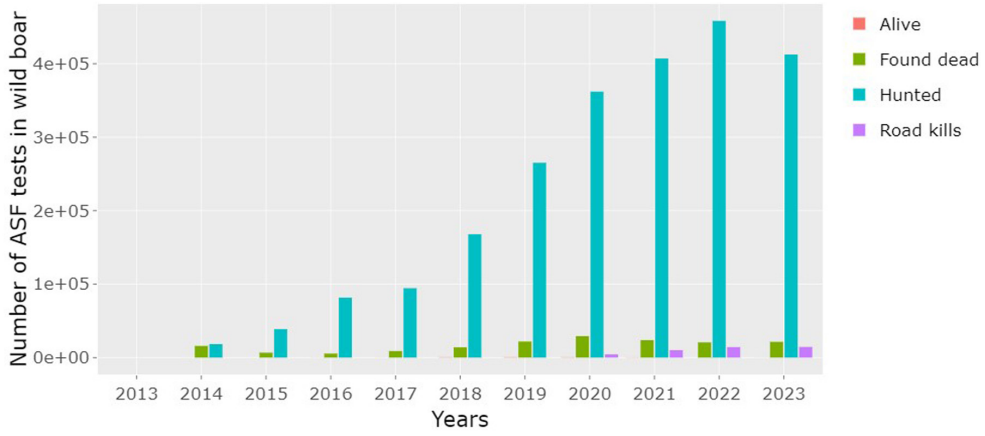

FIGURE 14 Number of samples from wild boar analysed for ASF by the reporting Member States per year, differentiating the type of animal sampled.

In 2023, approximately 65% of wild boar samples from Member States were tested by PCR only (293,496 samples), 27% were tested in parallel by PCR and ELISA (119,103 samples), 6.2% by PCR and IPT in parallel (27,663 samples), 1.8% by ELISA only (8203 samples), and 0.16% by one of the other tests such as IPT (730 samples). Most of these IPTs were conducted in Slovakia on samples taken from hunted wild boar, in parallel with PCR (95% of the total IPTs).

The positivity rates of wild boar samples differed between the tests used, and, importantly, between the types of wild boar samples. As shown in Table 3, the overall positivity rate was the highest for found-dead animals tested by PCR with 31% positivity (between 4% and 67%, depending on the country), consistent with previous reports (EFSA, 2022a, 2022b, 2023b). The overall positivity rates among hunted animals and road-killed wild boar tested by PCR were 0.4% (between 0% and 2%) and 0.5% (between 0% and 6%), respectively. It is noteworthily that 1.1% of all samples analysed by serological test were positive, with the highest positivity rates being reported among found dead wild boar from Greece (100%, although corresponding to one single sample), Slovakia (10%) and Romania (5.7%). Importantly, this positivity rate by ELISA does not include laboratory data from Bulgaria, that are not available for this report, but only the wild boar testing positive by ELISA reported through ADIS (see Section 3.2.1).

In North Macedonia, the number of wild boar samples tested for ASF increased by 33% in comparison with 2022. The classification of the samples differs slightly from the other countries due to differences in how data were collected. The percentage of PCR-positive samples from passive surveillance (equivalent to found dead) was 48%, and 2.4% from active surveillance (similar to hunted animals), which is quite similar to the percentages in 2022 (50% and 0.9%, respectively).

TABLE 3 Summary of the surveillance results for ASF per type of wild boar sampled, as reported by the affected countries.

			Serological tests[a]		PCR tests		Total	
	Sampled population	**Country**	**Tests**	**% POS**	**Tests**	**% POS**	**Tests**	**% POS[b]**
EU Member States	Alive	Romania	38	0	36	0	59	0
		Slovakia	2	0	2	0	2	0
	Total Alive		40	0	38	0	61	0
	Found dead or with clinical signs	Czechia	750	0	1190	3.9	1242	3.7
		Germany	–		5634	13	5634	13
		Greece	1	100	9	22	9	22
		Estonia	2	0	34	68	34	68
		Hungary	1	0	812	20	812	20
		Italy	–		3733	20	3733	20
		Lithuania	2	0	272	63	272	63
		Latvia	–		950	67	950	67
		Poland	262	0.8	7077	46	7090	46
		Romania	88	5.7	175	63	245	47
		Sweden	–		287	23	287	23
		Slovakia	523	10.3	1161	47	1161	47.7
	Total found dead or clinical signs		1629	3.8	21,334	31	21,469	30
Member States	Hunted	Czechia	4	0	3644	0.3	3644	0.3
		Germany	–		114,167	0.05	114,167	0.05
		Greece	–		1061	0	1061	0
		Estonia	7319	0.5	7356	0.2	7371	0.7
		Hungary	4033	0.8	53,371	0.5	53,371	0.5
		Italy	–		10,644	2	10,644	2
		Lithuania	23,718	1	23,762	0.4	23,771	1.4
		Latvia	–		20,706	1.4	20,706	1.4
		Poland	76,969	1	128,148	0.3	129,055	0.8
		Romania	14,430	1.6	14,723	1.4	22,524	1.9
		Sweden	–		66	0	66	0
		Slovakia	26,163	1.3	26,167	0.4	26,167	1.6
	Total Hunted		152,636	1	403,815	0.4	412,547	0.7
	Road kills	Czechia	513	0	924	0	983	0
		Germany	–		2295	0.1	2295	0.1
		Greece	–		2	0	2	0

	Sampled population	Country	Serological tests[a]		PCR tests		Total	
			Tests	% POS	Tests	% POS	Tests	% POS[b]
		Estonia	17	0	17	0	17	0
		Hungary	–		238	0.8	238	0.8
		Italy	–		4558	0.5	4558	0.5
		Lithuania	11	0	18	6	18	6
		Latvia	–		7	0	7	0
		Poland	19	0	6054	0.7	6054	0.7
		Romania	5	0	5	0	7	0
		Sweden	–		8	0	8	0
		Slovakia	268	0.4	370	2	370	2
	Total road kills		833	0.1	14,496	0.5	14,557	0.5
	Total surveillance		155,138	1.1	439,683	2	448,634	2
Non-EU countries and territoires	Passive surveillance	North Macedonia	–		65	48	65	48
	Active surveillance	North Macedonia	–		4120	2	4120	2
	Total surveillance		–		4185	3	4185	3

Note: The total number of samples tested does not equal the number of ELISA and PCR tests, since some samples were analysed by ELISA, PCR and/or other tests. (–) represents no data submitted.

[a]Serological tests include samples analysed by ELISA and/or confirmatory tests such as IPT and IB. For analysis purposes, the results of confirmatory tests prevail over ELISA results.

[b]A positive sample was defined as a sample that tested positive either by the PCR or by the serological test.

HIGHLIGHTS FROM THE WILD BOAR SECTION

Despite the introduction into new countries (Croatia, Greece and Sweden) and the spread in new areas of Italy, only a small increase (10%) in the number of notified wild boar outbreaks was observed in the EU in comparison with 2022.

Samples taken from hunted wild boar represented 92% of the samples analysed. Only 0.4% of them tested positive by PCR, still leading to the detection of 31% of the wild boar outbreaks. In contrast, samples taken from found-dead and road-killed wild boar represented 8% of the samples analysed. However, 31% of them tested positive by PCR, leading to the detection of 69% of the wild boar outbreaks in the EU.

Overall, 1.1% of the sampled wild boar were seropositive (this figure excludes Bulgaria), mostly in Romania, Lithuania, Poland and Slovakia, suggesting viral persistence in parts of these countries. These figures are stable over the years.

In Germany and Hungary, a notable decreasing trend was observed in the number of outbreaks in wild boar and proportion of positive PCR samples in the last 2 years. In Slovakia, a similar improvement was observed in the proportion of positive PCR samples, but only since 2022.

A clear seasonality with peaks in the proportion of positive samples was observed in Poland, Slovakia and Hungary. No clear seasonal patterns could be observed in the other affected Member States. Seasonal patterns probably reflect a combination of ecological factors (e.g. seasonality in transmission rates and in carcass detection probability due to vegetation), and human factors (e.g. seasonality in carcass search efforts and hunting intensity).

The number of potential secondary cases in wild boar increased in Germany and Poland, while decreased in Hungary and North Macedonia (non-EU) in comparison with 2022. However, this metric is highly influenced by the number of cases found in a small area and the intensity of surveillance activities.

In the non-EU countries and territories, ASF outbreaks among wild boar spread to previously disease-free areas as Bosnia and Herzegovina and north-western Serbia in comparison with 2022, with an increase in the number of notified outbreaks.

Among Member States, Poland had the highest number of ASF outbreaks among wild boar (2686 outbreaks, which was 34% of outbreaks in the EU), while in the non-EU countries and territories, Serbia had the highest number of outbreaks (213 outbreaks, which was 73% of outbreaks outside of the EU).

Sixteen new NUTS3 regions became infected in 2023 in comparison with 14 regions in 2022, located in Croatia, Sweden, Italy, Germany, Greece, Poland and Slovakia.

3.3 | Translocation events

In 2023, a few long-distance viral translocation events are worth noting. They resulted in outbreaks among domestic pigs or in wild boar in areas far distant from previously affected areas. These translocation events occurred in Italy and Sweden.

3.3.1 | Italy

During 2023, three long-distance translocation events occurred in regions far away from any previous case of ASF. More details on the epidemiology of these events and the genetic results of the isolates are described below.

Calabria: The first ASF-positive wild boar carcasses were found at the beginning of May in a national park with extremely wild and harsh terrain, including deep valleys, high mountain peaks and dense vegetation. This case was more than 500 km from any previously reported outbreaks (Lazio). In the following months, 17 positive carcasses were found in the area and six outbreaks among domestic pigs were notified in the region. In most of these establishments, the pigs were kept partially outdoors.

Campania: Also in May, five positive wild boar carcasses in a very advanced state of decomposition were found in a large forest area in Salerno Province (between Lazio and Calabria Regions), more than 200 km from any reported outbreaks. Similar to Calabria, the infected zone was close to a national park characterised by deep valleys and high mountains, with very dense vegetation. In those regions, 26 positive carcases were found until July 2023, but no outbreaks among domestic pigs were notified.

In both these regions, the results of the epidemiological investigations indicated that ASFv could have been circulating since the beginning of 2023. Since no ASF outbreaks have been reported in the directly neighbouring regions, an introduction via infected wild boar that could have migrated is unlikely, and therefore a human-mediated translocation seems realistic. No more precise hypotheses have been raised.

Sardinia: In September, a small pig establishment located in Nuoro province (restricted zone I for genotype I) became infected by ASF genotype II. The epidemiological investigations revealed that the most probable source of ASFv introduction on the establishment was infected food waste coming from one of the outbreaks in the northern affected regions of Italy.

Molecular analysis on positive samples from different Italian regions are ongoing. A double approach, both whole-genome sequencing (WGS) and multigene typing (MG), has been being performed. More than 100 complete ASFv genomes have been generated to date, collected from outbreaks in all Italian affected regions from 2022 and 2023. All ASFv complete genomes clustered on ASFv genotype II, with a high similarity to the other genotype II sequences previously described in European countries since 2014.

The results of WGS reveal the presence of some sporadic sequences with large deletions, which can be explained by mechanisms leading to genetic reorganisation such as homologous recombination. These isolates were identified in the north-western regions of Italy and in Calabria.

The MG approach (Gallardo et al., 2022) analyses the six variable regions (CVR, IGR I73R/I329L, O174L, K145R, IGR MGF5059R/10R and ECO2) and groups the isolates into 27 different groups. Based on this analysis, all the sequences from the north-western regions of Italy, in Campania and in Sardinia belong to genetic group 3, the most representative group in Europe, with isolates from Ukraine, Belarus, the Baltic States, Poland, Czechia, Romania, Moldova, Hungary and Slovakia. The sequences from 2022, those from Calabria and Lazio regions, belong to genetic group 19 together with isolates from Bosnia and Herzegovina (2023), Bulgaria (2018, 2019, 2020), Croatia (2023), Greece (2020), North Macedonia (2022), Romania (2018, 2021), Serbia (2019, 2020) and Sweden (2023). This genetic group is still present in Calabria, while the sequences collected in Lazio during 2023 belong to a new genetic group (27), never described before, characterised by a deletion of a tandem repeat sequence in the MGF region.

Additional essential markers like the single nucleotide polymorphism (SNPs) were studied and the deletion of the complete gene was identified in some Italian ASF sequences. To better understand the molecular epidemiology and pathogen evolution of ASFv and to verify the platform-specific limitations, especially in homopolymer and repeat regions, further studies are ongoing, i.e. the adaptation of nanopore technology to confirm the ASFv genomes sequences (article in preparation).

3.3.2 | Sweden

ASF was confirmed in Sweden for the first time in September 2023, in samples from wild boar found dead in Fagersta municipality in Västmanland county, approximately 170 km north-west of Stockholm and about 450 km from the nearest affected Member State. A long-distance translocation through human activities was assumed, but more precise pathways could not be identified. Between September and December, in total, 62 wild boar found dead ($n = 61$) or culled due to clinical disease ($n = 1$) tested positive for ASFV. The last positive case was confirmed in mid-November. Pathological investigations carried out on the carcasses suggested that the disease had been present in the area since sometime between May and June the same year, that the epidemic peak occurred between mid-August and mid-September, and that the last death was estimated to have occurred in late September.

In an effort to better understand the origin of the virus, WGS was carried out. A positive sample from one of the initial outbreaks with a relatively low Ct-value of 19 was selected and subjected to metagenomic next generation sequencing (NGS) using an Illumina MiSeq instrument (Illumina Inc., San Diego, CA, USA.) followed by typing as described by Gallardo et al. (2022). The MG analyses revealed that the virus belongs to genotype II, genetic group 19, the second most frequent cluster in the EU with 82 out of the 485 ASFv sequenced at the EU reference laboratory (EURL) between 2018 and 2023, with sequences from Bosnia, Bulgaria, Croatia, Greece, Italy, North Macedonia, Romania and Serbia and Sweden.

3.4 | Genotyping

Reporting countries were also asked about the genotyping analysis performed by them or by the EURL on their isolates during 2023. In total, eight Member States reported using the MG approach (Gallardo et al., 2022), while five reported performing WGS in some of their isolates during 2023. The approaches differed between countries. While some Member States used both methods (Italy, Hungary, Slovakia and Sweden), others applied one or the other (e.g. Germany analysed 19 samples by WGS, while Croatia, Estonia and Poland only used the MG approach in 13, 18 samples and 44, respectively). Italy was the country that analysed the highest number of samples (120 samples) by both methods.

In the non-EU countries and territories, Serbia analysed 95 samples by MG and five by WGS, while Bosnia and Herzegovina analysed six by MG.

Despite the genotyping efforts performed, none of the genetic analyses were able to provide information on the origin of the viruses introduced into new regions. Differences in the application of the methodologies (i.e. analysis of four instead of the six recommended regions for the MG, and different approaches for the WGS) also make the interpretation and analysis of the data difficult. Harmonising methodologies and interpretation of genetic data, optimization of NGS for ASFv and sharing information is essential for transparency and creating databases with enough comparable data to allow future discrimination between the isolates.

3.5 | Impact of the disease

Estimating the impact associated with animal disease is very complex, as besides the direct costs associated with the death of the animals, many other aspects are affected including trade, welfare of the animals, society (e.g. disruption in outdoor activities including hunting, sport events, tourism). In this report, three main aspects were analysed, as indicators of the impact of ASF in affected countries: (i) the restriction zones due to ASF including the pigs and establishments in those areas; (ii) ASF impact in domestic pigs including outbreaks size, incidence, animals lost and, (iii) the wild boars reported as dead due to ASF and the evolution of wild boar abundance over time.

3.5.1 | Evolution of the ASF restricted zones

Restriction zones have an important role for controlling the disease, as they define the areas where prohibitions of movements and other measures are in force. Data from the European Commission on ASF restricted zones, as described in Annex I of Commission Implementing Regulation (EU) 2023/594, has been used to evaluate the size of ASF restricted zones at the EU global level since 2014 (Figure 15). For this graph, we considered two types of zones: restricted zones III (approximating the restricted zones due to the occurrence of ASF outbreaks among domestic pigs) and restricted zones II (approximating the restricted zones due to the occurrence of ASF outbreaks among wild boar). In the remainder of the report, by size of restricted zone in a given year, we refer to the mean size of the restricted zones in that year. Note that the most up-to-date map of these restricted zones is available online.[16]

As observed in Figure 15, no big changes occurred during 2023 in the size of the restricted zones when compared with 2022. Specifically, by the end of 2023, restricted zone III was 9000 km^2 smaller (−4%) than at the end of 2022, while restricted zone II increased by 6% in this period.

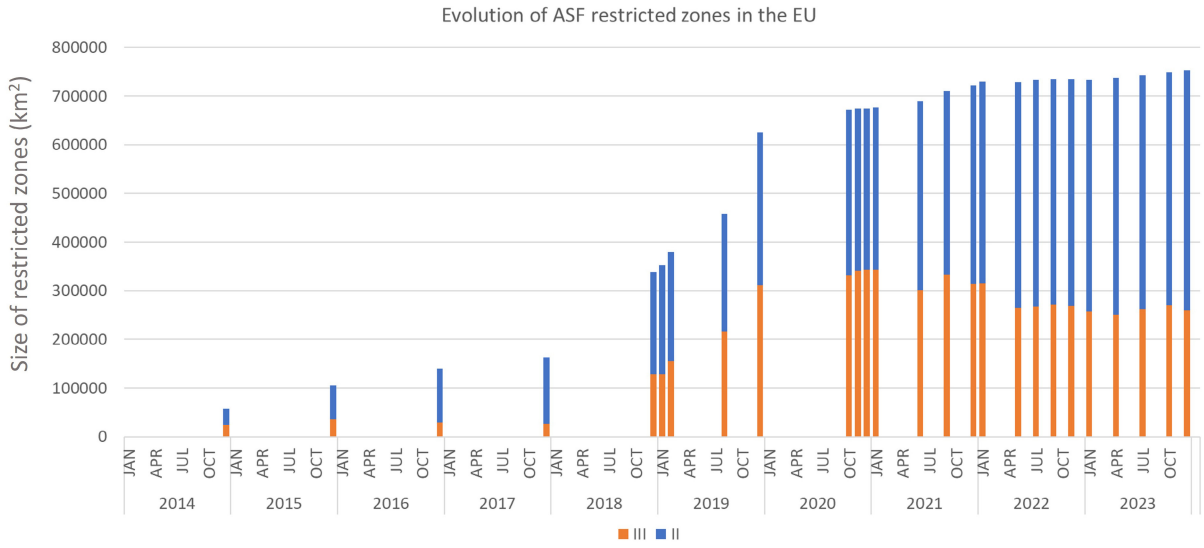

FIGURE 15 Evolution of the size of restricted zone III (in orange, due to the occurrence of ASF in domestic pigs) and restricted zone II (in blue, due to the occurrence of ASF in wild boar and/or domestic pigs) in the Member States from 2014 to December 2023.

Important differences are observed between Member States in relation with the restricted zone III, ranging from 0% to 100% of the affected Member State. In 2023, 91% of restricted zones III in the EU were in Romania, where the whole territory was under restriction zone III. In the rest of Member States, restricted zone III covered less than 10% of their national territories. In addition to the newly affected Croatia, and the recurrence of ASF in domestic pigs in Greece, the area under restricted zone III increased in Lithuania, Italy and Latvia. However, it remained stable in Romania, Germany, and Latvia, and decreased in Poland, Slovakia and Bulgaria.

Officially lifting the restrictions in affected areas, for domestic pig or wild boar, usually requires an absence of outbreaks for at least 12 months (Regulation (EU) 2023/594).[17] Therefore, it is likely that the decrease observed in restricted zones III in 2023 and previous years (EFSA, 2023a, 2023b) is the consequence of a reduction in the affected areas that started in 2020, driven mostly by Poland and Bulgaria (Figure 16).

[16] https://santegis.maps.arcgis.com/apps/webappviewer/index.html?id=45cdd657542a437c84bfc9cf1846ae8c.

[17] In exceptional situations, the restricted zones can be lifted earlier.

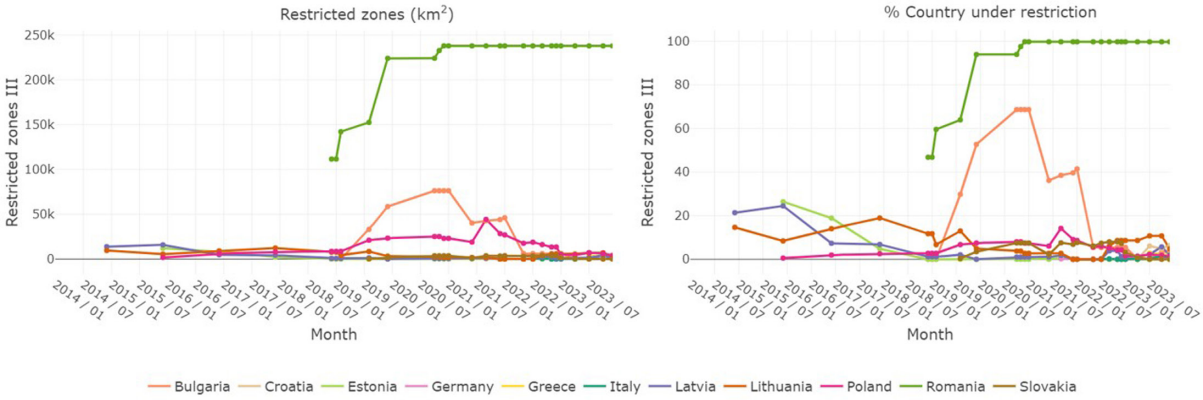

FIGURE 16 Evolution of the size of the restricted zone III (in km^2) (left) and the equivalent percentage of the country under restriction (right) for restricted zones III, per Member State, 2014–2023.

The situation totally differs when analysing the sum of restricted zone II and III (approximating the restricted zones due to the occurrence of ASF outbreaks either wild boar or domestic pigs). In 2023, five Member States (Bulgaria, Estonia, Latvia, Lithuania and Romania) had over 90% of their territory covered by restricted zones II + III (Figure 17). In Hungary, Poland and Slovakia these restricted zones constituted 37%, 44% and 56% of the territory, respectively. In Croatia, 5.9% of the territory is covered by these restricted zones, and less than 5% in Czechia, Germany, Greece, Italy and Sweden. In 2023, the size of restricted zones II + III increased slightly in Italy, Lithuania and Slovakia, while it remained stable in Bulgaria, Czechia, Germany, Estonia, Latvia, Poland and Romania, and decreased in Hungary.

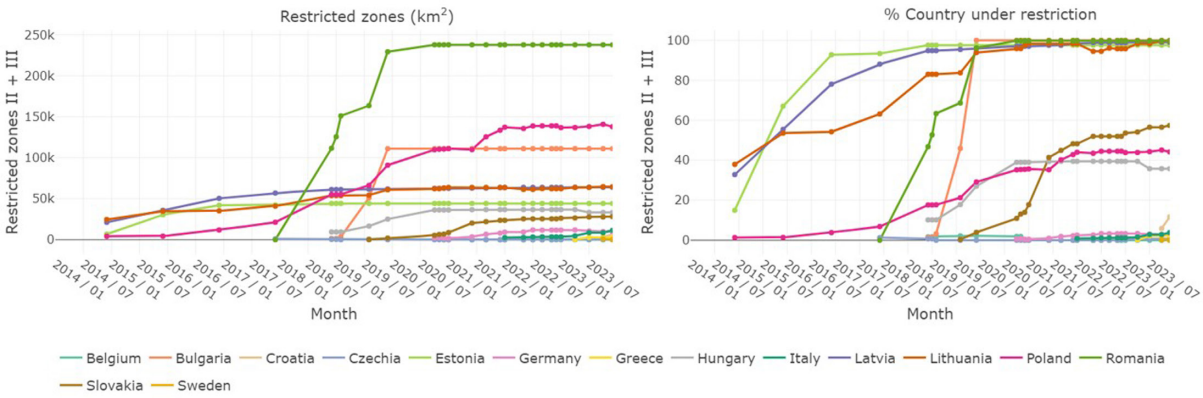

FIGURE 17 Evolution of the restricted zones (in km^2) (left) and the equivalent percentage of the country under restriction (right) for restricted zones II + III per Member State, 2014–2023.

It is important to note that although in some countries the area affected is not large (e.g. Italy 2% or Sweden 0.1%), the spread of the disease to newly affected areas might have a wide impact. For that purpose, the percentage of pig establishments and pigs located in restricted zones (III and II; as well as in restricted zone I where ASF was not reported but restrictions are in place) in the affected Member States was estimated for those that submitted pig population data. As seen in Table 4, the percentage of the industry affected varied considerably between countries, depending on the location of the pig production areas. For Greece and Slovakia, the largest commercial production is not in the areas affected, which is reflected in the smaller percentage of restricted pigs verus establishments. However, even when the restriction zones (due to wild boar or pig outbreaks) affect a low-density area or a small percentage of the industry, if the restricted zones include high-value production, this can have a big impact.

TABLE 4 Statistics on the country area, pigs and pig establishments under restriction in the Member States submitting pig population data.

Country	% country under restriction (zones I+II+III)	N. establishments	Establishments under restriction	% establishments under restriction	N. Pigs	% pigs under restriction	N. pigs under restriction
Czechia	< 0.1	4800	11	< 0.1	1,393,688	< 0.1	3264
Estonia	100	103	103	100	274,803	100	274,803
Greece	16	1331	310	23	743,367	9	63,484
Italy	7	67,103	3099	5	8,228,463	8	685,113
Lithuania	100	4448	4448	100	460,126	100	460,126
Latvia	99	2460	2460	100	306,042	100	306,042
Poland	62	51,481	28,855	56	9,357,540	56	5,283,742
Romania	100	366,971	366,971	100	2,709,671	100	2,709,671
Slovakia	65	3010	1744	58	496,161	31	151,703

3.5.2 | Impact caused by ASF in domestic pigs

The impact caused by ASF in domestic pigs in affected countries was assessed by the numbers and size of the outbreaks, the variations in the pig census (establishments and pigs) in comparison with previous year, the incidence, and number of pigs directly lost, either due to ASF or to the control measures implemented (Table 5). However, this analysis only considered the data officially notified in ADIS from the affected establishments. Some countries could have implemented additional measures (e.g. depopulation all establishments in the surrounding areas), but that data were not available for the current report.

In comparison with 2022 (Table 6), the number of outbreaks among domestic pigs increased in Romania (+409), Poland (+16), Italy (+15), Greece (recurrence, +6), Estonia (recurrence +2), Latvia (+2), and Bulgaria (+1); while it decreased in Lithuania (–13), Slovakia (–5) and Germany (–2).

At the same time, the number of establishments registered with the presence of at least one pig varied considerably in certain countries in comparison with 2022. For example, the number of pig establishments decreased in Czechia (–12%), Italy (–19%), Latvia (–17%), Lithuania (–20%) and Poland (–7%), while they increased considerably in Romania (+27%). In most of these countries, the biggest change occurred in small establishments (< 100 pigs), which open and close more frequently. Small establishments can easily close in newly affected areas, when restrictions and stricter biosecurity requirements are implemented in the area (e.g. newly affected territories in Italy) or prices of pigs are decreasing. At the same time, they can also easily reopen, when restrictions are lifted or prices increase.

In Poland, the number of small establishments decreased in 2023, while the bigger ones increased, leading to an increase in the total number of pigs in the country. In Romania, the opposite phenomenon was observed, where the number of small establishments increased considerably in 2023 in comparison with 2022, but this did not lead to an increase in the number of pigs, as most of these establishments were small. In 2022, 35% of small establishments in Romania were closed in comparison with 2021, coinciding with an important decrease in incidence (from 0.4% to 0.1%). In contrast, in 2023 the incidence in Romania doubled in small establishments (from 0.1% to 0.2%), together with the increase in the number of establishments. In Poland, the incidence increased (doubled in both large and small establishments), still reflecting a low incidence overall (0.04% and 0.1%).

As previously mentioned, the total number of outbreaks in the EU was driven by the newly infected Croatia and Romania, and the outbreaks at small establishments (≤ 100 pigs). However, in five Member States (Estonia, Italy, Latvia, Poland and Romania), a higher incidence was observed in larger establishments (> 100 pigs) than in small ones (Table B.2 Appendix). This was also observed in 2022 (EFSA, 2023) and is in agreement with previous observations from Estonia (Nurmoja et al., 2020), where herds with > 100 pigs were shown to be at a higher risk of infection. However, considering the very limited number of large establishments in those countries, the incidence is highly influenced by a few outbreaks, and should be interpreted carefully (e.g. in Latvia, with one outbreak notified among the 57 establishments with more than 100 pigs, the incidence in this category was 1.75% compared to 0.3% in smaller establishments); Appendix B, Table B.2. Of the 14 outbreaks reported in Romania in establishments with more than 100 pigs, 9 were at establishments with > 1000 pigs (median 16,000 pigs, min. 1600, max. 56,000). These outbreaks emphasise the importance of constantly keeping the level of biosecurity high at this type of establishments. Still, further studies are necessary to investigate the impact of herd size and the potential risks.

The numbers of pigs lost due to ASF (number of susceptible pigs in affected establishments as reported in ADIS) reflected whether larger commercial establishments were infected or only smaller establishments. In the affected Member States that submitted data on pig population, the overall percentage of domestic pigs lost due to ASF was 0.9%. This varies between countries, with the lowest percentage of 0.007% in Lithuania to the highest percentage in Romania, where 7% of the pig population was lost due to ASF in 2023 (Table 5). It is important to note that the estimated losses in the domestic pig sector do not cover the losses indirectly caused by the disease such as preventive culling or trade restrictions.

TABLE 5 Summary statistics of the domestic pig population (number of establishments and pigs) and the impact of ASF on those by country for the reporting year. (–) data not reported.

					Establishment							Domestic pigs					
			Restricted zone III (mean % of country)[b]		No. of establishments[c]		No. of outbreaks[d]			Establishment incidence (%)[e]		No. of pigs[c]		No. of pigs dead or culled due to ASF (losses[f])			
	Country	First outbreak date[a]	2022	2023	2022	2023	2022	2023	Total from first outbreak	2022	2023	2022	2023	2022	2023	Total from first outbreak	% Losses 2023
Member States	Bulgaria	2018-08-31	11.4^{X}	2.6^{X}	1348		2	3	75	0.1		616,049		6	3	147,221	
	Czechia		0	0	5449	4800						1,339,460	1,393,688				
	Croatia	2023-06-26		4.3			0	1124	1124					0	24,227	24,201	
	Estonia	2015-07-21	0^{X}	0.3^{X}	96	103	0	2	30	0	2	269,355	274,803	0	9398	53,818	3.4
	Germany	2021-07-15	0.1^{X}	0.14^{X}			3	1	8					2903	11	7470	
	Greece	2020-02-05		1.8		1331	0	6	7		0.5		743,367	0	959	991	0.13
	Hungary			0													
	Italy	2022-06-09	0.07^{X}	0.5^{X}	82,779	67,103	1	16	17	0.00121	0.02	8,569,824	8,228,463	9	20,382	20,391	0.25
	Lithuania	2014-07-24	3.89^{X}	8.71^{X}	5584	4448	16	3	160	0.3	0.07	501,375	460,126	2257	30	77,878	0.006
	Latvia	2014-06-26	1.5^{X}	2.5^{X}	2965	2460	6	8	83	0.2	0.3	330,369	306,042	1512	269	53,549	0.08
	Poland	2014-07-23	5.7^{X}	1.7^{Y}	55,384	51,481	14	30	532	0.03	0.06	8,911,683	9,357,540	3064	8505	182,693	0.09
	Romania	2017-07-31	100	100	288,447	366,971	327	736	6677	0.1	0.2	2,824,028	2,709,671	149,282	184,093	1,670,236	6.8
	Sweden																
	Slovakia	2019-07-24	7.42^{X}	0.81^{Y}	3018	3010	5	0	44	0.2	0	496,827	496,161	525	0	53,282	0
	Total		–	–	445,070	501,707	374	1929	8757	–	–	23,858,970	23,969,861	159,545	247,877	2,291,730	–
Non-EU countries and territories	Bosnia and Herzegovina	2023-06-22					0	1511	1511					0	60,281	60,281	
	Kosovo[1]*	2023-07-16					0	9	9					0	172	172	
	North Macedonia	2022-01-06			4456	2983	30	16	46	0.7	0.5	140,767	122,372	1126	10,458	11,584	9.5
	Serbia	2019-07-31					107	992	1165					334	50,843	53,636	
	Total	–	–	–	4456	2983	159	2584	3120	–	–	140,767	122,372	33,634	121,754	125,673	–

[a]First outbreak date in domestic pigs notified through ADIS.

[b]Percentage of country area under restrictions, i.e. registered as restricted zone III. Super indexes indicate whether there is a significant difference (5%) between the two consecutive years.

[c]Number of establishments/pigs reported from each country to EFSA though the data collection framework. Establishments not registered as farms or pasture (e.g. abattoir, market, etc.) are not included, neither are establishments with zero pigs registered.

[d]Outbreaks notified through ADIS.

[e]Outbreaks notified through ADIS divided by number of establishments.

[f]Losses were estimated by the number of susceptible pigs present in affected establishments as notified through ADIS. Losses related with additional measures (e.g. depopulation in the surrounding areas) are not included here as no data were available.

The incidence of ASF at domestic pig establishments at NUTS 3 level (number of establishments affected in the NUTS 3 region/number of establishments present in the NUTS 3 region) is represented spatially in Figure 18A for the 10 affected countries that reported pig populations data. An average establishment incidence per NUTS 3 region of 0.38% was observed, highly influenced by the 82% of NUTS 3 regions with no outbreaks notified from Member States submitting pig population data. Approximately 13 NUTS 3 regions had an incidence above 1%, with the highest incidence of 20% observed in a region in the north of Greece, where one outbreak occurred among the five establishments recorded in the area. Despite being one of the Member States most affected by ASF, the incidence in most of NUTS 3 regions in Romania was lower than 1%, due to the large number of establishments across the country.

The percentage of pigs lost due to ASF per NUTS 3 region (pigs died or culled due to ASF/number of pigs reported for that region), was generally low (1% on average) for the countries reporting pig data (Figure 18B). As expected, the occurrence of outbreaks at large establishments highly influenced the proportion of pigs lost in the NUTS 3 regions, and the regions with a higher proportion of pigs lost were mostly located in Romania, in the same regions where the large outbreaks occurred (Figure 18C). When considering the size of the outbreaks in the Member States (Figure 18C), only six establishments of more than 10,000 pigs were affected, all of them in Romania. In 2022, five establishments of this size were affected, also in Romania. As previously mentioned, in all affected countries, most of the outbreaks were on establishments with fewer than 100 pigs (96%) and a few outbreaks were notified in establishments with 1000–10,000 pigs: in Romania (3), Estonia (1), Italy (5) and Poland (3). The other Member States only reported outbreaks at establishments with fewer than 1,000 pigs.

North Macedonia was the only non-EU territory that submitted pig population data. Here, the average establishment incidence per NUTS 3 region was 0.5% in 2023, while the average proportion of pigs lost due to ASF per NUTS 3 region was 0.6%. Both parameters decreased from 2022 (0.7% incidence and 0.8% losses), in parallel with the number of pig establishments registered. The small pig establishments (< 100 pigs) decreased by 44% during 2023, potentially contributing to the better control of the disease in the country, in comparison with the large increase of outbreaks in neighbouring countries.

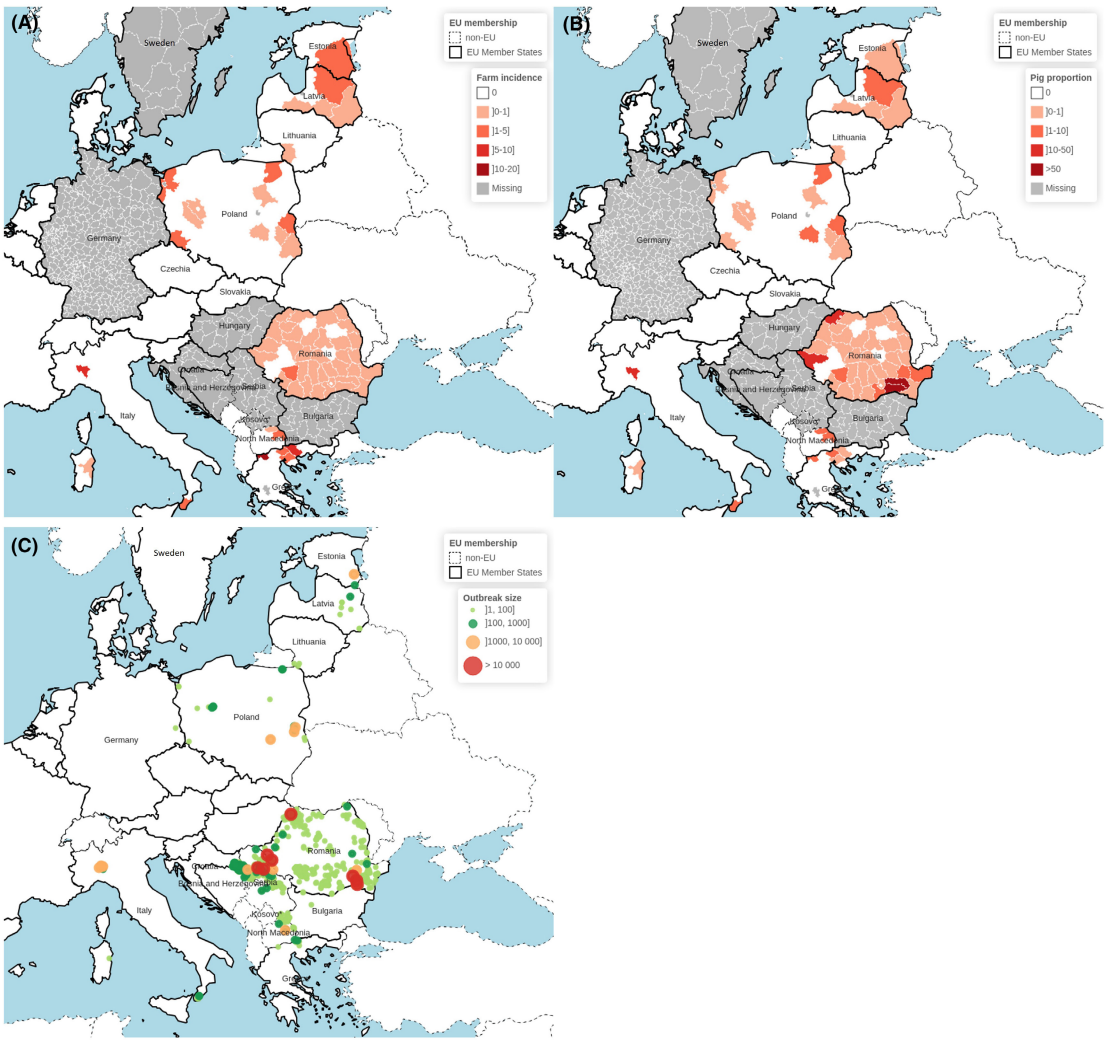

FIGURE 18 Spatial distribution of the impact of ASF in 2023. (A) Incidence of ASF per affected establishment per NUTS 3 region. (B) Proportion of pigs lost due to ASF per NUTS 3 region. (C) ASF outbreaks in domestic pigs by size of the establishment affected during 2023. © EuroGeographics for the administrative boundaries.

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3.5.3 | Impact caused by ASF in wild boar

As previously described in the temporal dynamics, the number of ASF outbreaks among wild boar in the Member States increased by 10% in 2023, while the overall EU restricted zone II increased by 6%.

The number of reported wild boar dead or killed positive to ASF (i.e. the cumulative number of individuals reported through ADIS as positive cases, dead and killed) in the Member States showed an increase of 9% comparing with the previous year (Table 6). However, there is variation between countries. In Germany, this number decreased from 2022 to 2023 by 44%. In contrast, Bulgaria, Poland and Italy saw an increase of 15%, 60% and 290% was observed. In Czechia, the number of outbreaks also increased from one to 56, and the disease remained closely confined to the affected areas.

In the non-EU-affected countries and territories, the total number of reported wild boar dead or killed positive to ASF in 2023 was 385, three times more than the previous reporting year, mostly driven by the increased number of outbreaks reported from Serbia.

The apparent proportion of losses in relation to the estimated wild boar population size in the affected countries was on average 0.45%, with the maximum of 2.1% in Latvia. Higher apparent proportions of losses in certain countries (e.g. Latvia, Lithuania and Poland) can be the result of a higher absolute number of wild boar lost, a lower wild boar abundance caused by ASF in previous years, or potentially a more intense search of wild boar carcasses. In Lithuania and Latvia, a rebound of the population has been observed since 2020, which could explain the new wave of the disease in those areas. However, overall low proportions of wild boar lost to ASF in the affected countries can be considered an underestimation because of (i) under-detection of carcasses (potentially heterogeneous between countries) and (ii) an additional or increased wild boar harvest as an ASF control measure (i.e. a reduction of the population density). While the latter does not represent a direct impact of the virus on wild boar populations, it is indirectly related to the presence of ASF and as such could be added to ASF-induced mortality.

TABLE 6 Summary statistics on the wild boar population (wild boar density) and the impact of ASF by country for the year 2023.

	Country	Date of first confirmed outbreak among wild boar	Wild boar abundance[d]	% country under restriction zone II + III (mean % over the year)[a]		Notified number of wild boar outbreaks[b]			Notified number of losses[c]			
				2022	2023	2022	2023	Total from first outbreak	2022	2023	Total from first outbreak	% Losses 2023
	Bulgaria	2018-10-23	4.4	100^X	100^X	305	653	2106	436	756	3786	0.1
	Croatia	2023-07-05	3.4		8.78	0	13	13	0	14	14	0.007
	Czechia	2017-06-26	1.8	0.06^X	0.6^Y	1	56	287	1	56	287	0.04
	Germany	2020-09-10	2.2	3.1^X	3.04^X	1600	888	5442	1600	888	5602	0.1
	Estonia	2014-09-08	0.6	98^X	98^X	53	53	3013	77	76	4284	0.3
	Greece	2023-01-20	3.5		1.67	0	2	2	0	2	2	0.0004
	Hungary	2018-04-21	1.3	40^X	37^Y	568	403	9302	698	444	12,948	0.4
	Italy	2022-01-07	2.9	1^X	2.45^Y	268	1051	1319	269	1050	1319	0.1
	Lithuania	2014-01-24	0.7	96^X	98^Y	307	436	4914	670	580	8844	1
	Latvia	2014-06-26	0.7	99^X	99^X	913	730	6097	1274	1002	8257	2
	Poland	2014-02-17	1.4	44.2^X	44.3^X	2113	2686	17,992	2572	4106	27,253	1
	Romania	2018-05-29	0.6	100	100	450	289	3568	738	420	7980	0.3
	Sweden	2023-09-06	0.9		0.1	0	60	60	0	62	62	0.03
	Slovakia	2019-08-08	1.9	51.3^X	55.6^Y	561	535	3169	778	708	5230	0.7
	Total	–	–	–	–	7139	7855	57,932	9113	10,164	86,665	–
Non-EU countries and territories	Bosnia and Herzegovina	2023-07-15				0	29	29	0	55	55	
	Kosovo[1]*	2023-07-17				0	4	4	0	9	9	
	North Macedonia	2022-03-21	4.3			10	47	57	20	93	113	0.08
	Serbia	2020-01-03	1.2			146	213	471	108	228	422	0.2
	Total		–	–	–	156	293	561	128	385	599	–

[a]Superscript letters indicate whether there is a significant difference (5%) between the two consecutive years.

[b]Wild boar outbreaks refer to ASF outbreaks in wild boar as notified through the Animal Diseases Information System (ADIS).

[c]Losses include the number of wild boar found dead, cases and killed as reported to ADIS.

[d]Based on the modelled density of wild boar as published by the ENETWILD Consortium et al. (2022).

Countries were also asked about hunting and depopulation measures. In all the Member States, except in the newly infected Croatia and Sweden, hunting is permitted in the restricted zones. In some of them, only individual hunting was permitted, while trapping and culling was only allowed in the core areas of Germany and some areas of Italy. Depopulation measures were reported to be applied in 9/13 Member States and 2/4 non-EU countries and territories. However, the extent and application of this is quite variable, from hunting applied in the whole country, to targeted figures in very specific areas (e.g. restricted zone I or high-risk areas with neighbouring countries).

Differences in surveillance efforts between countries and the estimated sizes of wild boar populations highly influence the estimated wild boar losses. The affected Member States also reported the means of performing systematic searches or active patrols for wild boar carcasses. The most popular method reported by the affected Member States was the use of trained staff (9/13), followed using dogs (4/13), and lastly, using drones (3/13). In Italy, Germany and Poland, the three methods were used although not always systematically, while in Greece, trained staff and dogs are used. In the others (Croatia, Lithuania, Slovakia, Romania and Sweden), trained staff are used, being most commonly performed by hunters, forest personnel and hunting ground managers.

Countries were also asked about the estimated effort put into carcass search. Sweden estimated their efforts as 1100 person-days, considering that the area searched was 774 km^2 and that one person on average could cover 0.7 km^2 per search day (min. = 0.15 km^2, max. = 2.4 km^2, median = 0.58 km^2). In Slovakia, an average of 16–24 h per area/week was reported, depending on the area and the epizootic phase. Other Member States reported difficulties in estimating these efforts. However, having good information on the search efforts is essential to evaluate the efficacy of the surveillance and the confidence in the results obtained, as previously demonstrated by Belgium during the eradication of ASF.

Similarly, in the non-EU countries and territories, trained staff (forestry guards or teams of specially trained hunters) were used in three out of four responding countries, hunting dogs were used in Bosnia and Herzegovina, and no drones were used. Additional information can be found in Table A.3 in Appendix A.

Temporal trends in the size of wild boar populations (approximated by the hunting bags) among the affected countries are presented in Figure 19. The collection, harmonisation and cleaning of hunting data are very tedious, but essential to follow the evolution of wildlife populations. These data, provided by the ENETWILD Consortium, are essential to be able to evaluate the management strategies and the impact of the disease and policies on wild boar populations.

In all the affected countries, wild boar numbers show an increasing trend since 2000, with some interannual fluctuations. In the Baltic States, after the big decrease of hunting bags observed in the first 5 years of ASF, the increasing trend started in 2020/2021 and continued during the last hunting season. In central Europe (Germany, Czechia and Poland), a potential decrease could have started last season, although is too early to confirm that.

In Bulgaria and Romania, the decrease in the number of hunting bags started immediately after ASF introduction and seems to continue in Romania, while it might have stabilised in Bulgaria. In Bulgaria, the sharp decrease in the number of hunting bags indicates an important decrease in the number of wild boar, probably due to ASF-induced mortality. However, the number of notified outbreaks among wild boar is not very high, and most of the outbreaks reported were detected through serology in hunted wild boar, not from dead animals. Whether the population in these countries will follow the same pattern as that in the Baltic States, with a resurgence in the coming years, is something to be observed in the future.

The estimations from all affected countries were standardised across ASF-affected countries on the timescale centred around the year of ASF introduction. The average, maximum and minimum were calculated and plotted on the bottom right of Figure 19. Until the introduction of ASF, a clear increasing pattern in the wild boar population size was observed with relatively small variability between countries (Figure 19). During the first 3 years after ASF introduction, this increasing pattern slowed down, then stopped and eventually turned into a decreasing trend although important variability in this decreasing trend was seen between countries. Moreover, after 7 years of ASF presence, a rebound in the wild boar population size can be seen.

In the last report, it was observed that different numerical responses of wild boar populations to ASF introduction are related to the surface area of the country affected by the disease (EFSA, 2023b). This might be the reason behind the important decrease observed in countries widely affected by ASF (e.g. the Baltic States, Romania, Bulgaria), in comparison with the more erratic patterns in countries where the disease affects a limited area (e.g. Germany, Poland, Czechia).

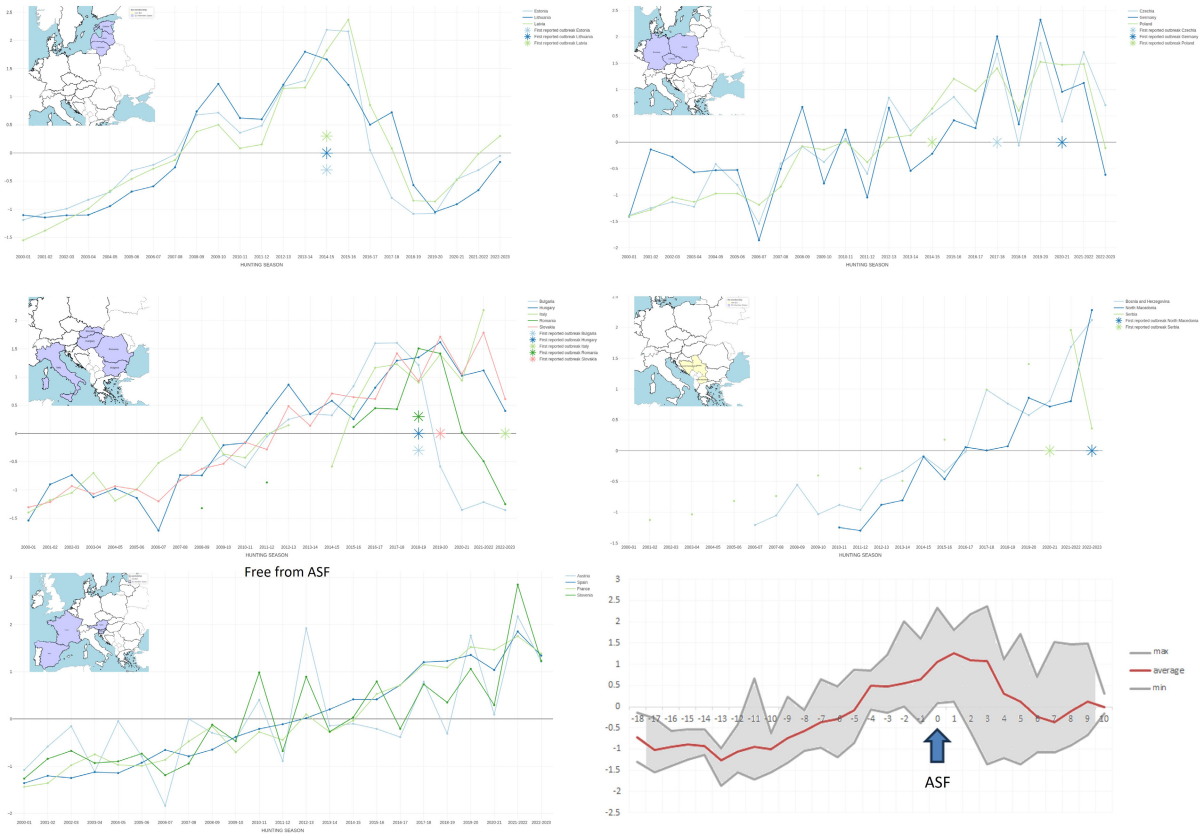

FIGURE 19 Standardised annual hunting bag in the European ASF-affected and selected non-affected countries. Bottom-right panel shows the average (min.-max.) standardised hunting bag across ASF-affected countries on the timescale centred around the year of ASF introduction. The standardised hunting bag was calculated by z-score calculation (subtracting the average of the country over the hunting seasons from each data point and dividing by the standard deviation).

HIGHLIGHTS FROM THE IMPACT OF THE DISEASE

Despite the introduction of ASF in domestic pigs in Croatia and the increase in the number of outbreaks, the total size of the restricted zones III in the EU was slightly reduced (–4%). This was influenced by the highly clustered outbreaks in the newly affected Croatia, and the reduction of restricted zone III in Poland, Slovakia and Bulgaria.

The total size of the restricted zones II slightly increased in 2023 (+6%), due to the new countries affected (Sweden, Croatia and Greece) and spread in previously affected ones (Italy, Slovakia and Lithuania), while it decreased in Hungary.

A decrease in the number of pig establishments, especially at small establishments (< 100 pigs), was observed in Lithuania (–20%), Latvia (–17%) and Italy (–19%). In contrast, the number of small establishments increased in Romania (+27%), simultaneously with an increase in the incidence.

In 2023, the establishment incidence of ASF at NUTS 3 level was 0.38% in the EU-affected countries reporting pig population data.

The direct losses were highly concentrated in areas where the larger outbreaks were notified, such as the regions of Romania where outbreaks with more than 10,000 pigs occurred.

The overall number of wild boar dead or killed positive to ASF in the Member States showed an increase of 9% compared with the previous year. There is considerable variation between countries in this number. In Germany, the number of wild boar dead or killed positive to ASF decreased by 44% between 2022 and 2023. In contrast, in Bulgaria, Poland, and Italy, an increase of 73%, 60% and 290% was observed, respectively.

The apparent proportion of losses in relation to wild boar population in the affected countries was on average 0.45%, with the maximum of 2.1% in Latvia.

The analysis of the annual hunting bags at country level identified an increase of the wild boar population in the Baltic States, a decrease in Germany, Hungary, Poland, Romania and Slovakia, and stabilisation in Bulgaria. The decreasing trends in Romania, Hungary and Slovakia since the introduction of ASF followed a similar pattern observed in the Baltics after ASF introduction.

4 | CONCLUSIONS

- In the EU during 2023, ASF was notified for the first time in Croatia (in domestic pigs and wild boar) and Sweden (in wild boar only), reoccurred in Greece (free since 2021) and spread to new areas of Italy.
- In the non-EU countries and territories, ASF was notified for the first time in Bosnia and Herzegovina and Kosovo[1*] (in domestic pigs only), and an important increase of the number of outbreaks was observed in Serbia in comparison with 2022.
- For domestic pigs, 2023 has been the year with the largest number of ASF outbreaks since ASF was introduced into the EU in 2014, with a total of 1929 outbreaks in the EU (mostly in Croatia and Romania) and 2528 outbreaks in non-EU countries and territories (mostly in Bosnia and Herzegovina and Serbia).
- For wild boar, the 7855 outbreaks notified by Member States in 2023 was slightly more than in 2022 (7139), but still considerably lower than in 2020 and 2021. This corresponds to a 9% increase of the number of dead wild boar compared with 2022, with considerable variation between countries.
- In 2023, for the first time, the number of samples analysed as part of the passive surveillance of domestic pigs in affected countries exceeded the number of samples analysed as part of active surveillance.
- In the Member States, 94% of ASF outbreaks among domestic pigs were detected through passive surveillance based on clinical suspicion, 3% were identified through contact tracing from affected establishments, and 3% of outbreaks (54) were identified by the weekly testing of at least two dead pigs (enhanced passive surveillance). The enhanced passive surveillance resulted in the detection of ASF in 11 out of the 18 outbreaks that occurred at establishments with more than 1000 pigs. No outbreaks were detected through active surveillance targeting healthy pigs at slaughter, before movement or, randomly selected at establishments.
- Overall, 31% of the wild boar carcasses found as part of the passive surveillance tested positive for ASFv by PCR, representing 69% of the wild boar outbreaks in the EU. In contrast, around 0.4% of the hunted wild boar tested positive by PCR, representing 31% of the wild boar outbreaks.
- Like previous years, the distribution of ASF in 2023 was clearly seasonal for domestic pigs in all countries, with 88% of the outbreaks among domestic pigs at small establishments reported between July and October. For wild boar, the seasonality was less clear, with a seasonal trend (winter peak) observed only in Poland, Slovakia and Hungary. This seasonality in wild boar was not synchronised with that in domestic pigs.
- In some Member States, the epidemiological situation improved: in Germany and Hungary a decreasing trend in both the proportion of PCR-positive samples from dead wild boar and the total number of notified outbreaks were observed. In Slovakia, a similar improvement was observed in the proportion of positive PCR samples, as well as the absence of domestic outbreaks during the last year.
- Despite the genotyping efforts performed, none of the genetic analyses were able to provide information on the origin of the viruses introduced into new regions.
- Despite the introduction of ASF into new countries and the increase in the number of outbreaks, the total size of the restricted zones III in the EU was slightly reduced (−4%), while the total size of the restricted zones II slightly increased in 2023 (+6%).

5 | RECOMMENDATIONS

- Clinical suspicion remains the main form of detecting ASF in domestic pig establishments. Therefore, all countries in Europe are encouraged to continue running awareness campaigns targeting farmers and veterinarians.
- For the detection of ASF in domestic pigs, it is advised to focus surveillance efforts on passive surveillance and thereby reduce the efforts dedicated to active surveillance of healthy pigs at slaughter, before movement or randomly selected at pig establishments.
- In areas considered to be at risk and in restricted zones, the weekly sampling of two dead pigs at each establishment (enhanced passive surveillance) should continue, particularly at large establishments of more than 1000 pigs.
- For the detection of ASF in wild boar, surveillance efforts should prioritise passive surveillance, including the search and testing of wild boar carcass, rather than active surveillance (testing hunted wild boar).
- Collection of harmonised and complete data, e.g. on laboratory results, host populations (pig and wild boar) and surveillance efforts (e.g. carcass search), is encouraged to ease the assessment of the epidemiological situation at the European level.
- Collection of reliable hunting data and timely submission to ENETWILD is highly recommended to be able to monitor the evolution of wild boar populations.
- Up-to-date census of pig establishments is essential to allow timely control of the disease and avoid rapid spread, as observed in the bordering areas of Croatia, Bosnia and Herzegovina and Serbia.
- Good practices in relation to virus genotyping, including the optimisation of WGS for ASFv, the increase of the number of isolates sequenced and the prompt sharing of sequence data, are recommended to increase the knowledge and the ability to trace isolates at finer scales.
- The stimulating cooperation of affected countries with EFSA experienced this year (and previous years), including the timely submission of epidemiological data as described in the ASF guidelines, is paramount and should continue in the coming years to ensure the accurate and precise assessment of the epidemiological situation and the formulation of tailored recommendations.

ABBREVIATIONS

ADIS Animal Disease Information System
ASF African swine fever
ASFv African swine fever virus
DCF Data collection framework
ELISA enzyme-linked immunoassay
IB immunoblotting test
IPT immuno-peroxidase test
NGS next generation sequencing
PCR polymerase chain reaction
WGS whole genome sequencing

ACKNOWLEDGEMENTS

EFSA wishes to thank the members and observers of the EFSA subgroup on African swine fever that provided the data and reviewed the report; the European Union Reference Laboratory on ASF that reviewed the genotyping section and provided updated information, and Paolo Calistri and Christian Gortazar from the EFSA AHAW Panel for reviewing the report.

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.

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European Commission

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EFSA-Q-2022-00380

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How to cite this article: EFSA (European Food Safety Authority), Ståhl, K., Boklund, A. E., Podgórski, T., Vergne, T., Abrahantes, J. C., Cattaneo, E., Papanikolaou, A., & Mur, L. (2024). Epidemiological analysis of African swine fever in the European Union during 2023. *EFSA Journal*, *22*(5), e8809. https://doi.org/10.2903/j.efsa.2024.8809

APPENDIX A

Countries and territories responses to the questionnaire

TABLE A.1 Countries and territories responses to the questions regarding active surveillance activities carried out on domestic pigs.

Country	Test healthy pigs before movement	Test pigs at slaughter	Test healthy pigs randomly on establishments
Bulgaria			
Croatia	NA	NA	NA
Czechia	In the whole restricted zones, the competent authority may decide to perform laboratory examination of healthy pigs before movements	NA	NA
Estonia	NA	Pigs at slaughter are tested in the whole country	The test of healthy pigs randomly in farms is performed in the whole country
Germany	Healthy pigs are tested before movements in the whole restricted zones	Pigs at slaughter are tested in the whole restricted zones	The test of healthy pigs randomly in farms is performed in the whole country
Greece	Healthy pigs are tested before movements in the whole restricted zones	NA	NA
Hungary	Healthy pigs are tested before movements in the whole restricted zones	Pigs at slaughter are tested in the whole restricted zones	NA
Italy	Following outbreaks in Lombardy (August–September 2023), movement restrictions for domestic pigs were required both for life and for slaughter, in Lombardy and in the other involved regions, as well as on the whole national territory. Clinical examination, a check of the mortality trend, spleen sampling from two recently dead pigs or blood sampling in non-healthy animals in the affected/linked regions; a specific authorisation for movement by the competent authorities, in the national territory. Moreover, ASF virological testing on spleen was required for the pigs found dead both during the transport to the slaughterhouse, and during stay awaiting before slaughter. These stricter regulations were adopted from September to November 2023	NA	NA
Latvia	NA	NA	NA
Lithuania	NA	Pigs at slaughter are tested in the whole country	NA
Poland	NA	Pigs at slaughter are tested in the whole restricted zones	NA
Romania	NA	NA	NA

(Continues)

TABLE A.1 (Continued)

Country	Test healthy pigs before movement	Test pigs at slaughter	Test healthy pigs randomly on establishments
Slovakia	Healthy pigs are tested before movements in the whole restricted zones	Pigs at slaughter are tested in the whole restricted zones	The test of healthy pigs randomly in farms is performed in the whole restricted zones
Sweden	NA	NA	NA
Bosnia and Herzegovina	Yes, in the whole country CVO comment – there is no surveillance (Passive or Active) in domestic pigs in the Country level. Passive and Active surveillance in domestic pigs is conducting only in one part of the Country, only in B&H Entity Republic of Srpska, mainly because of distribution of pig population. So, the term 'Whole Country' represent territory of one part of Bosnia and Herzegovina, and that is Entity Republic of Srpska VF – VI-VFS UNSA has no information about the purpose of sampling	Yes, in the whole country CVO comment – there is no surveillance (Passive or Active) in domestic pigs in the Country level. Passive and Active surveillance in domestic pigs is conducting only in one part of the Country, only in B&H Entity Republic of Srpska, mainly because of distribution of pig population. So, the term 'Whole Country' represent territory of one part of Bosnia and Herzegovina, and that is Entity Republic of Srpska VF – VI-VFS UNSA has no information about the purpose of sampling.	Yes, in the whole country CVO comment – there is no surveillance (Passive or Active) in domestic pigs in the Country level. Passive and Active surveillance in domestic pigs is conducting only in one part of the Country, only in B&H Entity Republic of Srpska, mainly because of distribution of pig population. So, the term 'Whole Country' represent territory of one part of Bosnia and Herzegovina, and that is Entity Republic of Srpska VF – VI-VFS UNSA has no information about the purpose of sampling
Kosovo[1]*	NA	NA	Test of healthy pigs randomly in farms is performed in the whole country
North Macedonia	Healthy pigs are tested before movements in the whole restricted zones	Pigs at slaughter are tested in the whole restricted zones	Test of healthy pigs randomly in farms is performed in the whole country
Serbia	Healthy pigs are tested before movements in the whole country	Pigs at slaughter are tested in the whole country	The test of healthy pigs randomly in farms is performed in the whole country

TABLE A.2 Countries and territories responses to the questions related to wild boar management strategies.

Country	Is wild boar hunting permitted in restricted areas?	Are depopulation measures (surplus culling in addition to regular management plan) in place? Specify the areas
Bulgaria		
Croatia	Wild boar hunting is not allowed in restricted zones	Depopulation measures are adopted in the whole country. Increased hunting is obligatory to reduce wild boar population to 10% of a biological minimum
Czechia	Yes, wild boar hunting is permitted in the whole restricted areas	Only hunting is adopted as depopulation measure in the whole restricted zones
Estonia	Yes, wild boar hunting is permitted in the whole restricted zones	Yes, in some cases if ASF PCR-positive wild boar has been detected then hunters will try to hunt all wild boars in that area or from the same group
Germany	Yes, in all EU legislative zones. But in the German legislative core areas within the restricted areas only trapping is allowed after establishment, in some areas stricter measures apply, whereby hunting is allowed but not for consumption, only for removal	Yes, in restricted areas and the high-risk zone along the Polish border
Greece	Yes, wild boar hunting is permitted in specific part of the restricted areas	Yes, depopulation measures are applied in the whole country

TABLE A.2 (Continued)

Country	Is wild boar hunting permitted in restricted areas?	Are depopulation measures (surplus culling in addition to regular management plan) in place? Specify the areas
Hungary	Yes, in part I of restricted zones individual wild boar hunting is allowed	Yes, in the whole country depopulation measures are in place. The main strategic goal is to reduce the wild boar density to 0.5 wild boar/km^2 by 28.2.2025 in whole country
Italy	According to the National Law in force (Ordinance n.5/2023 of Extraordinary Commissioner), collective hunting WB activities in RZII/RZIII are not allowed, whereas WB population control activities are permitted under specific conditions of biosecurity. All hunting activities for other species are allowed, as well as the use of hunting dogs in hunting training activities, provided that they comply with the approved protocol of biosecurity. WB hunted carcasses in RZII/RZIII should be destroyed but, by the way of derogation, they can be treated (risk-mitigating treatments, annex VII, Regulation UE 2020/687) in order to marketing them for human consumption, after ASFV virologically testing. In RZI hunting activities are allowed for WB population reduction measures; hunted WBs should be tested, and they can be used for self-consumption in the same restriction zone if negative. In all restriction zones, traps are allowed in order to catch and cull WBs	In Italy a total of one million of WB is estimated living. In the ASF free national territory, a Plan for WB depopulation requires to depopulate about 600.000 WB in the first year, with an increase of 96% over than the average culling during 2019–2021; target are planned for each region, based on the estimated population. Moreover, in the urban and periurban zones, in the protected areas (regional/national parks), in the regional areas of high pig density and high risk of viral introduction, the objective is to obtain 100% of WB depopulation. The allowed activities are use of traps and hunting low impact techniques, whereas the collective hunting should be performed only in a small rate
Latvia	Yes, wild boar hunting is not limited in the whole country	NA
Lithuania	Wild boar hunting is permitted in the whole country	NA
Poland	Yes, at the area of 'blue zone'. The individual hunting is preferred	Yes, depopulation measures are applied around the area adjacent to the 'blue zone'
Romania	Yes, hunting is permitted by all methods, respecting biosecurity measures	NA
Slovakia	Yes, wild boar hunting is allowed. In part II, only individual hunting is performed, while in part I and buffer zone, individual and collective hunting are allowed	Hunting in the whole country is not limited
Sweden	No, wild boar hunting was not permitted in the whole restricted zones Live wild boar in the restricted zones has been targeted for depopulation. This has been done by specific appointed hunters, culling the wild boars at baiting stations and traps. These animals have been sampled and destroyed	Depopulation measures are applied in the whole restricted zones, live wild boar in the restricted zones has been targeted for depopulation Hunters are encouraged to decimate the wild boar population in areas adjacent to the restricted zone
Bosnia and Herzegovina	Yes, wild boar hunting is permitted in the whole country	Yes, depopulation measures are in place in the whole country
Kosovo[1]*	NA	NA
North Macedonia	Yes, wild boar hunting is permitted in the whole country. Sanitary hunting (animals with clinical signs) in restricted zones	No. In non-infected hunting grounds, enhanced hunting
Serbia	Yes, hunting wild boar was permitted in the whole territory For a standstill period according to the epidemiological situation (60–90 days) after prohibition period expired, the hunting of wild boars is permitted under control and certain conditions (no use of dogs and no driven hunt allowed regularly)	Depopulation measures were applied in other zones different from restricted zones or non-restricted areas Foreseen by the ordinance in surrounding (buffer) areas to infected hunting grounds, established as high-risk zones (acting white zones), with the aim of decreasing of the wild boar population and increasing the hunting pressure towards the infected area

TABLE A.3 Countries and territories responses to the question on performing active patrolling of wild boar carcasses search.

Country	Use of dogs, drones and/or trained staff
Bulgaria	
Croatia	Only trained staff method is implemented. Designated hunters are involved in active searching under the responsibility of the hunting association. The estimated effort done is different between different hunting grounds
Czechia	None of the three methods for active patrolling search of wild boar carcasses is applied
Estonia	None of the three methods for active patrolling search of wild boar carcasses is applied
Germany	All three methods are applied: • specially trained dogs are used repeatedly to search for carcasses, frequency depends on the region and the local conditions. The estimate of the effort done is dependent on each region, thus cannot be estimated as a whole. • drones are used to detect carcasses; frequency is determined by the regional authorities depending on the local conditions and the season. • trained staff is used in specific areas, but seldom.
Greece	Only dogs and trained staff are used as method to perform active patrolling of wild boar carcasses search
Hungary	None of the three methods for active patrolling search of wild boar carcasses is applied
Italy	All three methods are applied: • Since 2019, the national dog board (ENCI) trained a number of detection dogs for active search of WB carcasses. The detection teams (dog and his trainer) worked in affected territories, for instance in Piedmont and Liguria, but use of dogs was not systematic in this activity. Currently, several regions are jointing to ENCI in order to create trained regional teams to be used for enhanced passive surveillance if needed. No effort study was conducted, although the use of detection dogs in environmental conditions such as dense undergrowth, showed to support definitively WB search activities • Actually, Italian affected zones are not suitable for use of drones (wooded area with dense and rough vegetation). Nevertheless, in some territories large and not wooded for instance in Emilia Romagna (Piacenza province, where the mountainous terrain is barren and treeless in some zones), drones were used sometimes. Hopefully, however, more use would be possible in the future. No effort study was conducted, due to the environmental limitations to the use of drones in the national territory • Usually, when a new region becomes ASF affected, the active search of WB carcasses is performed immediately by volunteers, mainly hunters, who are no longer available after a certain period of time. In some cases, armed forces and law enforcement are involved, as well as faunistic personnel. Trained staffs from specialised private companies were enrolled in Lombardy. Due to the proximity to the infected territory in Piedmont, Lombardy was listed in RZI on February 2022; since then and during 2023, region activated the search of WB carcasses, performed by trained and contracted personnel. Emilia Romagna region also used a private company, from June 2022 (some municipalities of Piacenza province were listed in RZI) to August 2023; due to administrative matters, region stopped the employment of private company for the following months of 2023. Data related to the estimate effort are not available
Latvia	None of the three methods for active patrolling search of wild boar carcasses is applied due to the too large, infected territory
Lithuania	Only the trained staff method is used If the positive wild boar is detected, the managers of the affected hunting ground are obligated by the national legislation to actively search for the dead wild boar for 1 month at least once a week, first looking in the resting and feeding places of wild boars and close to the water sources
Poland	All three methods are applied: • The use of trained dogs was limited (used in about 4% of actions). It increased the number of wild boars carcasses found. • The use of drones was limited (used in about 1,5% of actions). A larger area was patrolled in a shorter time. • Use of trained stuff of State Forests, Polish Hunting Association and Veterinary Inspection was implemented. Efficient search of wild boar carcasses.
Romania	Only the trained staff method is used. According to the 2023 'Pig Law': The managers of the hunting grounds have the obligation to periodically patrol the hunting ground area to detect the carcasses of wild boars, in order to ensure the clearing of the territory. As compensation, the equivalent amount for 12 L of fuel/1000 ha/month are paid for carrying out patrols in order to detect wild boar carcasses
Slovakia	Only the trained staff method is used Hunters search for carcasses within their hunting ground Wild boars are searched at every visit to the area, on average it is about 16–24 h per area/per week, depending on the phase of the epizootic in which the area is located. In the epizootic phase (high mortality) it is usually more

TABLE A.3 (Continued)

Country	Use of dogs, drones and/or trained staff
Sweden	Only trained staff method is applied Local hunters, familiar with the area, were engaged in organised search for cadavers within the restricted zones. The hunters received biosecurity training before being allowed to enter the restricted areas. The search paths and patrolled areas were registered and reported using GPS on a daily basis. The endeavours were continuously followed, and search efforts were assessed and prioritised in weekly meetings with the authorities to ensure effective and complete area coverage The area searchable by foot, excluding water or built-up areas, was 774 km^2, and we estimated that one person covered on average 0.7 km^2 per search day, due to some areas being dense young deciduous forest and areas hard to search on foot due to the landscape. This equals roughly to 1100 man-days
Bosnia and Herzegovina	Use of dogs (VIRS-hunting dogs) and trained staff (VIRS-hunters) methods are applied
Kosovo[1]*	Only trained staff method is applied. The MAFRD (Ministry of Agriculture Forestry and Rural Development) has a Forestry Agency that is in charge of Forestry, and employs Forestry guards who report dead wild boars to the KFVA
North Macedonia	None of the three methods for active patrolling search of wild boar carcasses is applied
Serbia	Only trained staff method is used There are special trained teams of hunters officially named and established on the local and regional level with the responsible leading person as a head of the hunting units. Most valuable as raised awareness, estimation is developing in relation to the scope and the purpose of their engagement

APPENDIX B

Supplementary material

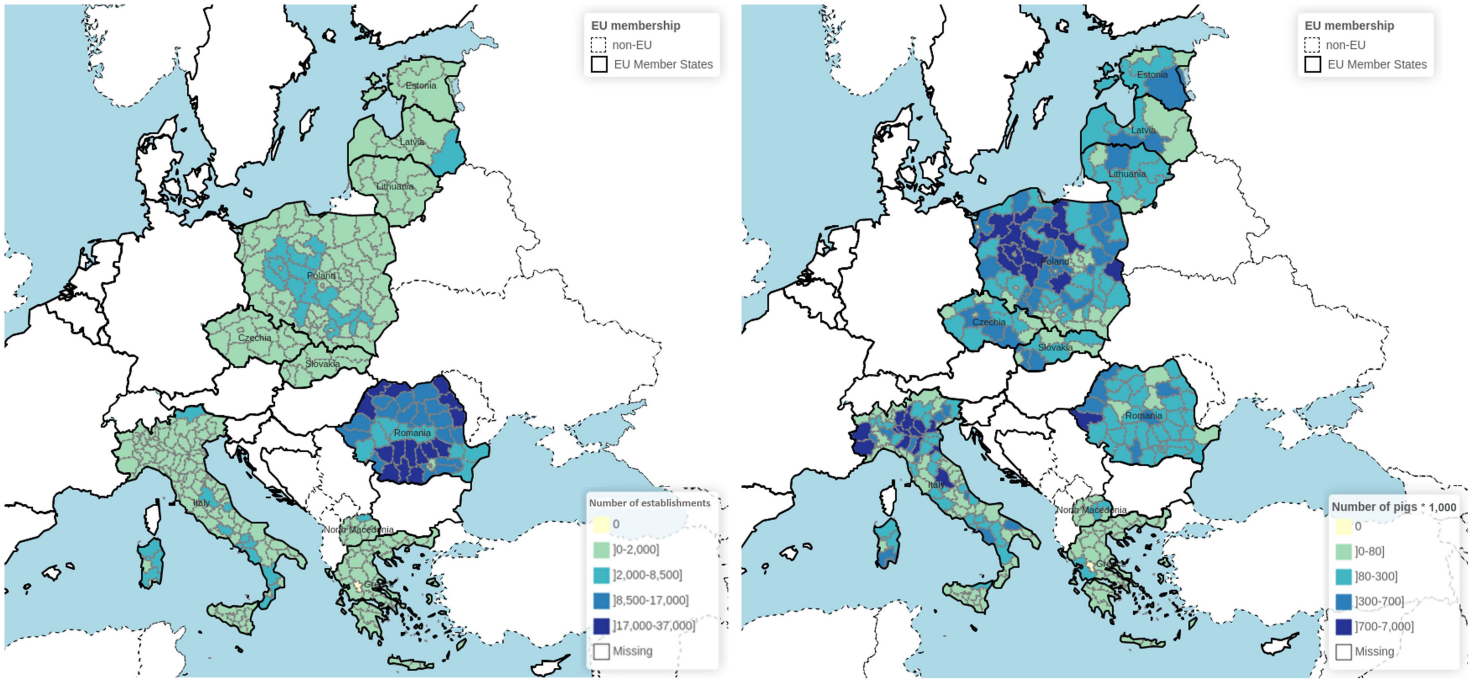

FIGURE B.1 Number of pig establishments per NUTS 3 region (left) and the number of pigs per NUTS 3 region (right) in 2023 as per the data reported to EFSA's Data Collection Framework. © EuroGeographics for the administrative boundaries.
Disclaimer: The designations employed and the presentation of material on this map 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.

TABLE B.1 Average number of potential secondary cases of ASF in wild boar per country in different reporting periods.

	Country	Date of first notification (included in analysis)	Average number of potential secondary cases in the year after the first notification (95% CI)	Average number of potential secondary cases in PREVIOUS reporting period (95% CI)	Average number of potential secondary cases in CURRENT reporting period (95% CI)	Overlapping coefficients for previous and current reporting period
Member States	Bulgaria	2018-08-31	1.8 (1.6–2.1)	2.0 (1.8–2.2)	2.2 (2.1–2.4)	0.2
	Estonia	2014-09-08	3.5 (3.1–3.9)	1.9 (1.5–2.3)	1.7 (1.4–2.2)	0.2
	Germany	2020-09-10	6.3 (5.9–6.7)	5.5 (5.1–5.9)	6.3 (5.8–6.7)	0.06
	Hungary	2018-04-21	3.2 (3.0–3.4)	2.4 (2.3–2.6)	2.1 (2.0–2.3)	0.06
	Italy	2022-01-07	2.6 (2.3–2.8)	2.6 (2.4–2.9)	2.9 (2.8–3.1)	0.2
	Latvia	2014-06-26	2.1 (1.9–2.2)	1.9 (1.8–2.1)	2.1 (2–2.2)	0.2
	Lithuania	2014-01-24	2.0 (1.6–2.4)	1.9 (1.8–2.1)	1.9 (1.7–2)	0.6
	Poland	2014-02-17	1.6 (1.3–1.9)	2.3 (2.3–2.4)	2.6 (2.5–2.7)	0.007
	Romania	2017-07-31	1.6 (1.4–1.9)	1.8 (1.6–1.9)	1.9 (1.8–2.1)	0.3
	Slovakia	2019-07-24	2.3 (2.1–2.6)	2.0 (1.9–2.1)	2.2 (2.0–2.3)	0.3
Non -EU	North Macedonia	2022-01-06	1.4 (1.0–1.8)	1.4 (1.0–1.8)	1.7 (1.4–2.1)	0.026
	Serbia	2019-07-31	2.0 (1.5–2.5)	2.1 (1.8–2.4)	2.1 (1.9–2.3)	0.82

TABLE B.2 Summary statistics for the domestic pig population (number of establishments and pigs) and the impact of ASF on those by country, divided by establishment size (< 100 or ≥ 100 pigs) for the year 2023.

					Establishment							Domestic pigs					
			Restricted area (mean % of country)[b]		No. of establishments[c]		No. of outbreaks[d]			Establishment incidence (%)[e]		No. of pigs[c]		No. of pigs dead or culled due to ASF (Losses)			
	Country	First outbreak date[a]	2022	2023	2022	2023	2022	2023	Total since first outbreak	2022	2023	2022	2023	2022	2023	Total since first outbreak	% Losses 2023
EU Member States	Belgium < 100																
	Belgium ≥ 100																
	Bulgaria < 100	2018-08-31	11.4[X]	2.6[X]	1248		2	3	51	0.16		9313		6	3	861	
	Bulgaria ≥ 100	2019-07-19	11.4[X]	2.6[X]	100		0	0	24	0		606,736		0	0	216,242	
	Czechia < 100				4915	4282						35,823	32,931				
	Czechia ≥ 100				534	518						1,303,637	1,360,757				
	Germany < 100	2021-07-15	0.1[X]	0.1[X]			1	1	4					35	11	52	
	Germany ≥ 100	2021-07-15	0.1[X]	0.1[X]			2	0	4					2868	0	7418	
	Estonia < 100	2015-07-21		0.3	21	27	0	0	10	0	0	343	274	0	0	50	0
	Estonia ≥ 100	2015-07-21		0.3	75	76	0	2	20	0	2.63	269,012	274,529	0	9398	32,783	0.04
	Greece < 100	2020-02-05		1.8		908	0	4	5		0.441		22,208	0	137	110	0.5
	Greece ≥ 100	2023-04-26		1.8		423	0	2	2		0.473		721,159	0	822	4	0.0006
	Croatia < 100	2023-06-26		4.3			0	1089	1089					0	15,593	894	
	Croatia ≥ 100	2023-06-27		4.3			0	35	35					0	8634	77	
	Hungary < 100																
	Hungary ≥ 100																
	Italy < 100	2022-06-09	0.09[X]	0.5[X]	78,590	63,100	1	8	9	0.00127	0.0127	346,091	294,140	9	218	227	0.07
	Italy ≥ 100	2023-06-21	0.09[X]	0.5[X]	4271	4073	0	8	8	0	0.196	8,223,733	7,934,323	0	20,164	20,164	0.3
	Lithuania < 100	2014-08-06	3.9[X]	8.7[X]	5523	4394	14	3	149	0.253	0.0683	19,497	15,620	65	30	639	0.2
	Lithuania ≥ 100	2014-07-24	3.9[X]	8.7[X]	61	54	2	0	11	3.28	0	481,878	444,506	2190	0	57,569	0
	Latvia < 100	2014-06-26	1.5[X]	2.5[X]	2898	2403	5	7	69	0.173	0.291	16,103	12,466	52	168	867	1.4
	Latvia ≥ 100	2014-08-05	1.5[X]	2.5[X]	67	57	1	1	14	1.49	1.75	314,266	293,576	1460	101	32,470	0.03
	Poland < 100	2014-07-23	5.7[X]	1.7[Y]	44,104	39,452	9	18	403	0.0204	0.0456	992,767	956,958	336	563	9288	0.06
	Poland ≥ 100	2016-06-23	5.7[X]	1.7[Y]	11,280	12,029	5	12	129	0.0443	0.0998	7,918,916	8,400,582	2728	7942	146,451	0.09
	Romania < 100	2017-07-31	100	100	288,093	366,604	312	722	6477	0.108	0.197	1,194,980	1,074,447	2942	4752	64,580	0.4
	Romania ≥ 100	2018-06-15	100	100	354	367	15	14	200	4.24	3.81	1629,048	1,635,224	146,340	179,341	1,605,477	11
	Sweden < 100																
	Sweden ≥ 100																
	Slovakia < 100	2019-07-24	7.4[X]	0.8[Y]	2737	2728	3	0	37	0.11	0	38,889	38,723	153	0	578	0
	Slovakia ≥ 100	2020-08-17	7.4[X]	0.8[Y]	281	282	2	0	7	0.712	0	457,938	457,438	372	0	33,036	0
	Total	–	–	–	445,152	501,777	374	1929	8757	–	–	23,858,970	23,969,861	159,556	247,877	2,229,837	–

TABLE B.2 (Continued)

			Establishment									Domestic pigs					
			Restricted area (mean % of country)[b]		No. of establishments[c]		No. of outbreaks[d]			Establishment incidence (%)[e]		No. of pigs[c]		No. of pigs dead or culled due to ASF (Losses)			
	Country	First outbreak date[a]	2022	2023	2022	2023	2022	2023	Total since first outbreak	2022	2023	2022	2023	2022	2023	Total since first outbreak	% Losses 2023
Non-EU countries	Bosnia and Herzegovina < 100	2023-06-22					0	1411	1411					0	23,574	23,574	
	Bosnia and Herzegovina ≥ 100	2023-06-29					0	100	100					0	36,707	36,707	
	Kosovo[1]* < 100	2023-07-16					0	9	9					0	172	172	
	Kosovo[1]* ≥ 100																
	North Macedonia < 100	2022-01-06			4366	2907	28	12	40	0.641	0.413	26,716	15,105	500	242	740	1.6
	North Macedonia ≥ 100	2022-08-10			90	76	2	4	6	2.22	5.26	114,051	107,267	626	10,216	10,842	9.5
	Serbia < 100	2019-07-31					104	963	1131					1154	9072	11,077	
	Serbia ≥ 100	2020-07-02					3	29	34					471	41,771	41,905	
	Total		–	–	4456	2983	159	2580	3116	–	–	140,767	122,372	2751	128,929	312,281	-

[a]First outbreak date in domestic pigs notified to ADIS.

[b]Percentage of country area under restrictions, i.e. registered as restricted zone III. Superindices indicate whether there is a significant difference (5%) between the two consecutive years.

[c]Number of establishments/pigs reported from each country to EFSA though the data collection framework. Establishments not registered as farms or pasture (e.g. abattoir, market, etc.) are not included, neither are establishments with zero pigs registered.

[d]Outbreaks notified in ADIS.

[e]Outbreaks notified in ADIS divided by number of establishments.

APPENDIX C

Country data sets

TABLE C.1 Links to the ASF data sets for 2023 by reporting country. All country data sets are available on the EFSA Knowledge Junction community on Zenodo.

Country	Link to the data set
Czechia	https://doi.org/10.5281/zenodo.7821672
Estonia	https://doi.org/10.5281/zenodo.7801572
Germany	https://doi.org/10.5281/zenodo.7821688
Greece	https://doi.org/10.5281/zenodo.11057640
Hungary	https://doi.org/10.5281/zenodo.7821704
Italy	https://doi.org/10.5281/zenodo.7821723
Latvia	https://doi.org/10.5281/zenodo.7821780
Lithuania	https://doi.org/10.5281/zenodo.7821760
Poland	https://doi.org/10.5281/zenodo.7821816
Romania	https://doi.org/10.5281/zenodo.7821853
Slovakia	https://doi.org/10.5281/zenodo.7821894
North Macedonia	https://doi.org/10.5281/zenodo.7821796

TABLE C.2 Links to the pig population data sets for 2023 by reporting country. All country data sets are available on the EFSA Knowledge Junction community on Zenodo.

Country	Link to the data set
Czechia	https://doi.org/10.5281/zenodo.7821957
Estonia	https://doi.org/10.5281/zenodo.7801606
Greece	https://doi.org/10.5281/zenodo.11059352
Italy	https://doi.org/10.5281/zenodo.7821967
Latvia	https://doi.org/10.5281/zenodo.7822003
Lithuania	https://doi.org/10.5281/zenodo.7821977
Poland	https://doi.org/10.5281/zenodo.7822021
Romania	https://doi.org/10.5281/zenodo.7822034
Slovakia	https://doi.org/10.5281/zenodo.7822054
North Macedonia	https://doi.org/10.5281/zenodo.7822010