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Rapid Risk Assessment

HPAIV H5 in Germany

In Germany, around 1,000 HPAIV H5 cases in wild birds and 133 outbreaks in poultry and captive birds have been detected since 30. October 2020. In addition, many European countries continue to report outbreaks of HPAIV subtype H5 in captive birds and wild birds. The risk of spread in waterfowl populations and disease introduction in poultry farms and bird populations (e.g. zoological institutions) is considered high. Currently, there is a high risk of introduction of HPAIV subtype H5 through virus spread between poultry farms (secondary outbreaks). Utmost caution is indicated in (mobile) trade with live poultry. Biosecurity measures in poultry holdings should be reviewed and optimized where possible.

Rapid Risk Assessment for the introduction and further spread of HPAIV H5 in Germany

Background

The risk assessment from 22.02.2021 concerned HPAIV H5 events in Germany and Europe. Updated parcels of information are highlighted in yellow and include data up until 23.03.2021.

Situation in Germany

Since 30 October 2020, HPAIV H5-infected wild birds have been identified predominantly in dead birds on almost a daily basis and subsequently reported via the German Animal Disease Notification System (Tierseuchennachrichtensystem, TSN; Fig. 1). Fourteen federal states are affected thus far (here in chronological order of occurrence of cases): Schleswig-Holstein, Hamburg, Mecklenburg-Western Pomerania, Lower Saxony, Brandenburg, Bremen, Saxony, North Rhine-Westphalia, Bavaria, Berlin, Hesse, Baden-Württemberg, Thuringia and Rhineland-Palatinate (Fig. 2). The data indicate a supra-regional event that has spread geographically from northern Germany in a southerly direction (Fig. 1).

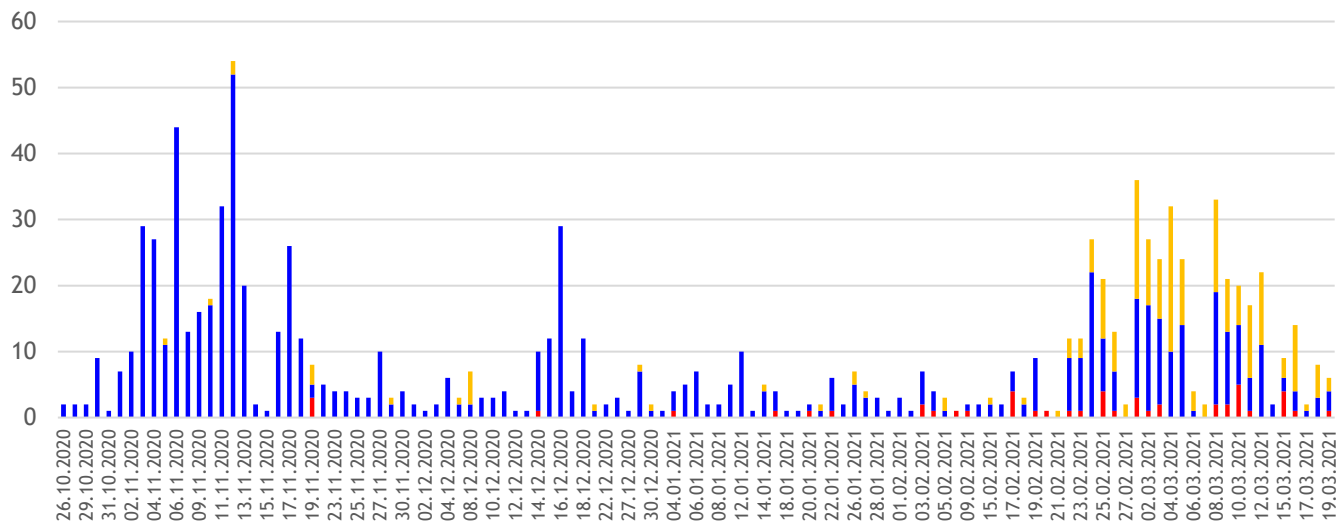

Figure 1: Chronology of reported HPAIV H5 cases in wild birds by time of sampling, roughly divided into northern (blue), central (yellow) and southern (red) Germany. Northern Germany (blue): Bremen, Hamburg, Mecklenburg-Western Pomerania, Schleswig-Holstein, Lower Saxony north of Hanover; Central Germany (Yellow): Berlin, Brandenburg, Hesse, Lower Saxony south of Hanover, North Rhine-Westphalia, Saxony, Saxony-Anhalt, Thuringia; Southern Germany (red): Baden-Württemberg, Bavaria, Rhineland-Palatinate (as of 23.03.2021).

The following federal states reported a total of 133 outbreaks in poultry and 3 outbreaks in captive birds as of 03 November 2020: Schleswig-Holstein (n=10), Mecklenburg-Western Pomerania (n=24), Lower Saxony (n=65), Brandenburg (n=11), Saxony (n=4), Hesse (n=1), Thuringia (n=1), Bavaria (n=8) and Rhineland-Palatinate (n=1), North Rhine-Westphalia (n=6), Berlin (n=1) and Saxony-Anhalt (n=1)(Fig. 2; Table 1). The outbreaks mostly affected commercial farms (n=96) and small non-commercial farms (n=31). All but one of the outbreaks was caused by the introduction of HPAIV H5N8. In one case, HPAIV H5N5 was detected in samples from a small holding in the district of Vorpommern-Rügen. Since 22.02.2020 Lower Saxony reported 35 new outbreaks predominantly in turkeys (n=22) and chicken (n=7), but also in domestic waterfowl (n=6) in the highly poultry dense counties of Cloppenburg (n=18) and Vechta (n=9). More details regarding outbreaks

since the 8th calendar week can be found in Table 1. Further suspicions in Baden-Württemberg and Thuringia are currently being investigated and are not included in the table.

Table 1: Confirmed HPAIV H5 outbreaks in poultry and kept birds since 22.02.2021 in Germany. Source: TSN (23.02.2021)

Bundesland	Municipality	Affected poultry	Production type	Number birds kept (*cumulative)	Confirmation
Berlin (1)	Berlin	Chicken	Hobby	10	01.03.2021
Brandenburg (4)	Prignitz	Turkey	Fattening	18.000	02.03.2021
	2x Märkisch Oderland	Turkey	Fattening	26.000*	05./11.03.2021
	Oder-Spree	Turkey	Fattening	10.000	13.03.2021
Bavaria (6)	2x Würzburg	Chicken	Layer	12*	25.02/4.03. 2021
	Schwandorf	Chicken	Breeding	50.000	04.03.2021
	Roth	Geese	Hobby	5	06.03.2021
	Kulmbach	Duck	Hobby	5	13.03.2021
	Würzburg	Geese	Zoo	>100	15.03.2021
Mecklenburg-Western Pomerania (8)	Landkreis Rostock	Chicken	Hobby	75	23.02.2021
	Vorpommern-Greifswald	Chicken	Hobby	60	27.02.2021
	Mecklenburgische Seenplatte	Chicken	Breeding	40.000	02.03.2021
	Vorpommern-Greifswald	Chicken	Zoo	50	05.03.2021
	2x Vorpommern-Rügen	Chicken	Hobby	400*	06./09.03.2021
	Vorpommern-Rügen	Geese	Hobby	24	12.03.2021
	Vorpommern-Rügen	Turkey	Fattening	15.000	12.03.2021
Lower Saxony (35)	Aurich	Chicken	Layer	12.000	24.02.2021
	6x Cloppenburg (Garrel)	Turkey	Fattening	62.000*	03.-16.03.2021
	2x Cloppenburg (Garrel)	Turkey	Fattening	9.000*	19.03.2021
	5x Cloppenburg (Bösel)	Turkey	Fattening	80.000*	28.02.-16.3.2021
	3x Cloppenburg (Emstek)	Turkey	Fattening	50.000*	16.-22.03.2021
	2x Cloppenburg (andere)	Turkey	Fattening	30.000*	28.02./16.3.2021
	Ammerland	Turkey	Fattening	15.000	16.03.2021
	Cuxhaven	Chicken	Fattening	28.000	10.03.2021
	2x Diepholz	Turkey	Fattening	50.000*	16.03.2021
	Diepholz	Chicken	Hobby	3	16.03.2021
	Vechta	Duck	Fattening	30.000	16.03.2021
	3x Vechta	Geese	Breeding	7.000*	18.-21.03.2021
	2x Vechta	Chicken	Layer	170.000*	28.2./6.3.2021
	3x Vechta	Turkey	Fattening	30.000*	16.-20.03.2021
	Wesermarsch	Chicken	Hobby	39	11.03.2021
	Wolfenbüttel	Chicken	Breeding	23	03.03.2021
North Rhine-West-phalia (6)	Gütersloh	Duck	Fattening	11.000	03.03.2021
	Paderborn	Chicken	Hobby	60	03.03.2021
	Minden-Lübbecke	Turkey	Breeding	7.000	06.03.2021
	Hochsauerlandkreis	Turkey	Fattening	7000	19.03.2021
	Paderborn	Chicken	Breeding	24.000	22.03.2021
	Warendorf	Chicken	Layer	160	22.03.2021
Saxony-Anhalt (1)	Altmarkkreis Salzwedel	Chicken	Hobby	21	18.03.2021
Schleswig-Holstein (4)	Rendsburg-Eckernförde	Geese	Hobby	28	05.03.2021
	Stormarn	Chicken	Breeding	141	05.03.2021
	2x Plön	Chicken	Layer	130.000*	06./12.03.2021
Saxony (2)	Zwickau	Chicken	Zoo	250	05.03.2021
	Mittelsachsen	Chicken	Hobby	20	09.03.2021

In wild birds, HPAIV H5 was most frequently detected in samples from dead Barnacle geese (*Branta leucopsis*), Whistling ducks (*Mareca penelope*) and other goose species. Other affected bird species groups

include gulls, snipe, owl and raptors (Fig. 4), including individual Peregrine falcons (*Falco peregrinus*), White-tailed sea eagles (*Haliaeetus albicilla*) and Eagle owls (*Bubo bubo*).

According to Schleswig-Holstein's 'State Agency for Coastal Protection, National Parks and Marine Conservation' (LKN.SH), more than 16,000 deceased or moribund waders and waterfowl have been identified in the area of the Wadden Sea coast (predominantly in the district of Nordfriesland) since 25.10.2020; this includes around 3,200 dead Red knots (*Calidris canutus*), a bird species belonging to the snipe family (*Scolopacidae*), since mid-December. The highest mortalities were found in Barnacle Geese (45%), Red knots (18%) and Wigeons (10%).

Since the end of February, cases in wild birds have again increased, with deaths currently affecting mainly swans and geese (Grey-lag and Canada geese) (Table 3; Fig. 4). However, HPAIV H5N8/N5 was detected not only in deceased but also in clinically healthy ducks and geese and in faecal samples from these birds.

Several virus subtypes circulate in wild bird populations (Table 2). Double infections were identified in a wigeon (H5N8+H5N1) and a white-tailed eagle (H5N8+H5N5).

Table 2: HPAIV H5 reassortants (subtypes) of clade 2.3.4.4B in wild birds since 01.10.2020 in Germany. Source: TSN. Status: 23.03.2021

Subtype (reassortant)	propor-tion	Affected bird species or groups
H5N8	91%	ducks, geese, swans all species, birds of prey, owls, gulls, heron, Oystercatcher, Lap wing, Whimbrel, Curlew, Curlew Sandpiper, corvids
H5N3	4%	Red knot, Curlew, Peregrine falcon
H5N5	3%	Eider duck, Wigeon, Mallard duck, Canada goose, Barnacle goose, Bean goose, buzzards, Black-headed gull, Herring gull, Mute swan, crow
H5N4	1%	Tufted duck, geese, Peregrine falcon, Herring gull, swans
H5N1	1%	Barnacle goose, geese, swan

Table 3: Reports received from the following regions or waters, see also Figure 3:

Bundesland	Affected waterbodies	Affected bird species or groups
Berlin	Berlin (Tegeler See, Spree, Havel)	geese, swans, cormorants
Brandenburg	Elsterniederung und westliche Oberlausitzer Heide, Borchetlsbusch und Brandkieten bei Freesdorf, Potsdamer Wald- und Havelseengebiet, Schwielowsee, Zeuthener See, Ruppiner Wald- und Seengebiet, Königswusterhausen (Stadtteich, Zeesener See), Unteruckersee, Großer Wünsdorfer See, Brandenburgische Elbtalaue, Oder	Grey-lag geese, swans, buzzards
Bavaria	Großer Rötelseeweiher am Regen, Mainaue Kulmbach, entlang des Main, Gewässer um Trabitz, schwarzer Regen, Rothsee, Naab, Donau bei Straubing, Fichtelgebirge, Schafbach bei Darstadt, Röhrach	Grey-lag geese, swans, Canada geese, herons
Hesse	Frankfurt, Offenbach (Maintal), Wechselsee und Rhein bei Biebesheim/Trebur, Obermosersee	swans, geese, Egyptian Goose, Eagle owl
Hamburg	Stadtparksee, Öjendorfer See, Dove Elbe, Alster, Osterbekkanal	swans, geese, Peregrine falcon, buzzard, gulls
Mecklenburg-Western Pomerania	Plauer See, Rödliner See, Tollensesee, Dassower See, Ostseeküste, Ruppensdorfer Teiche, Greifswalder Bodden, Peene, Wieker Bodden, Stralsunder Bodden, kleiner Jasmunder Bodden	Grey-lag geese, swans, gulls, birds of prey, Plover, herons, cormorants
Lower Saxony	Feuchtgebiet Dahrenhorst, Aller, Neetze, Weser, Ems, Dümmer, Harle	Grey-lag and Barnacle geese, swans, Grey heron, Coot
North Rhine-Westphalia	Weser, Hardtteiche bei Sendenhorst, Obersee Bielefeld, Rieselfelder Münster	Grey-lag and Canada geese, Grey heron
Rhineland-Palatinate	Rhein bei Bobenheim-Roxheim	Barnacle geese
Schleswig-Holstein	Wattenmeer, Eider, Ostseeküste und Travemündung, Plöner Seenplatte, Elbe, Elbmündung, Schlei, Schleimündung, Bordesholmer See, Wardersee, Nehmser See, Seekamper See, Segeberger See, Zarpener See	gulls, Barnacle geese, Common buzzard, Canada geese, swans, gulls, cormorants, ducks
Saxony	Talsperre Bautzen, Hofeteich bei Kamenz, Teiche bei Malschwitz, Elbe Dresden, Talsperre Quitzdorf, Ullerdorfer Teich, Berzdorfer See, Teilstaubecken Reichendorf, Elbe bei Meißen, Stegteich, Schäferteich, Zschornaer Teichgebiet, Kiessandtagebau Luppau, Gründelparkteich bei Glauchau	swans, geese, duck, bird of prey
Saxony-Anhalt	Muldestausee, Elbe, Alte Landwehr	Common buzzard, White-fronted goose, Heron, swans,
Thuringia	Schwanenteich Mühlhausen	Grey-lag geese, Coots

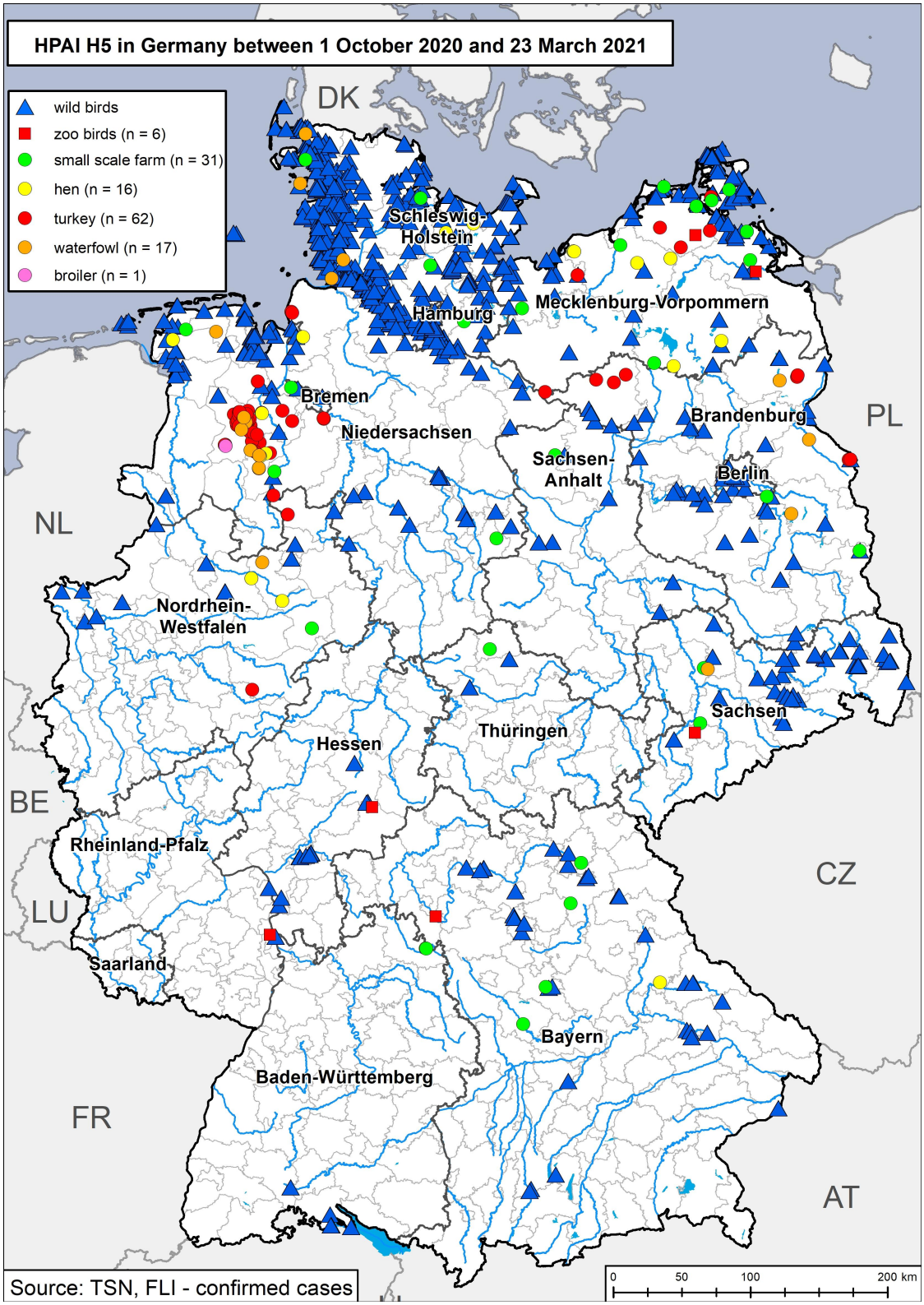

Figure 2: HPAIV H5 outbreaks in poultry and captive birds and cases in wild birds in Germany reported via TSN since 01 October 2020. (date: 23.03.2021). Symbols: See legend. Small-scale farming refers to poultry farms with up to 500 birds.

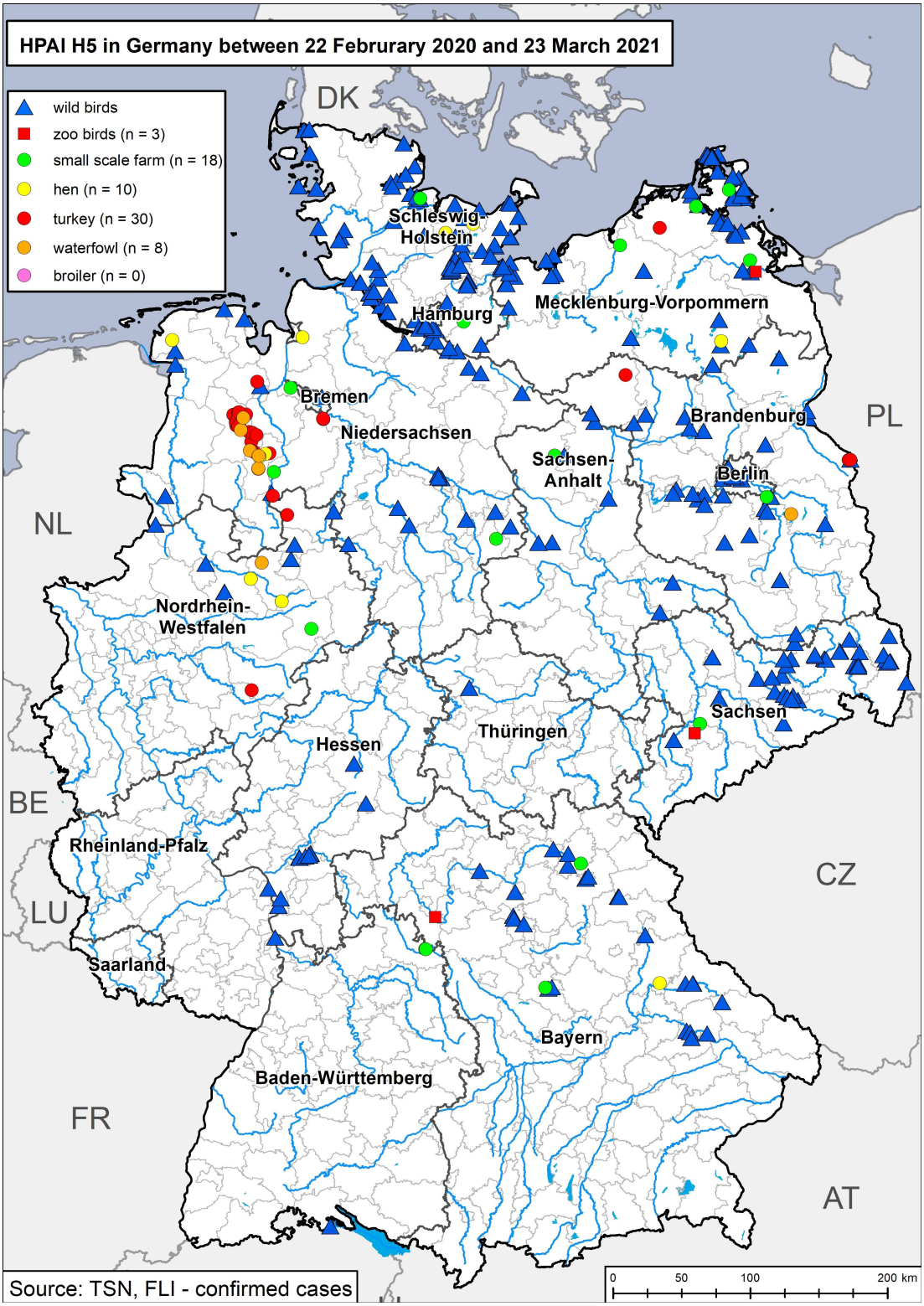

Figure 3*:* HPAIV H5 outbreaks in poultry and captive birds and cases in wild birds in Germany reported via TSN since February 22nd 2021. (date: 23.03.2021). Symbols: See legend. Small-scale farming refers to poultry farms with up to 500 birds.

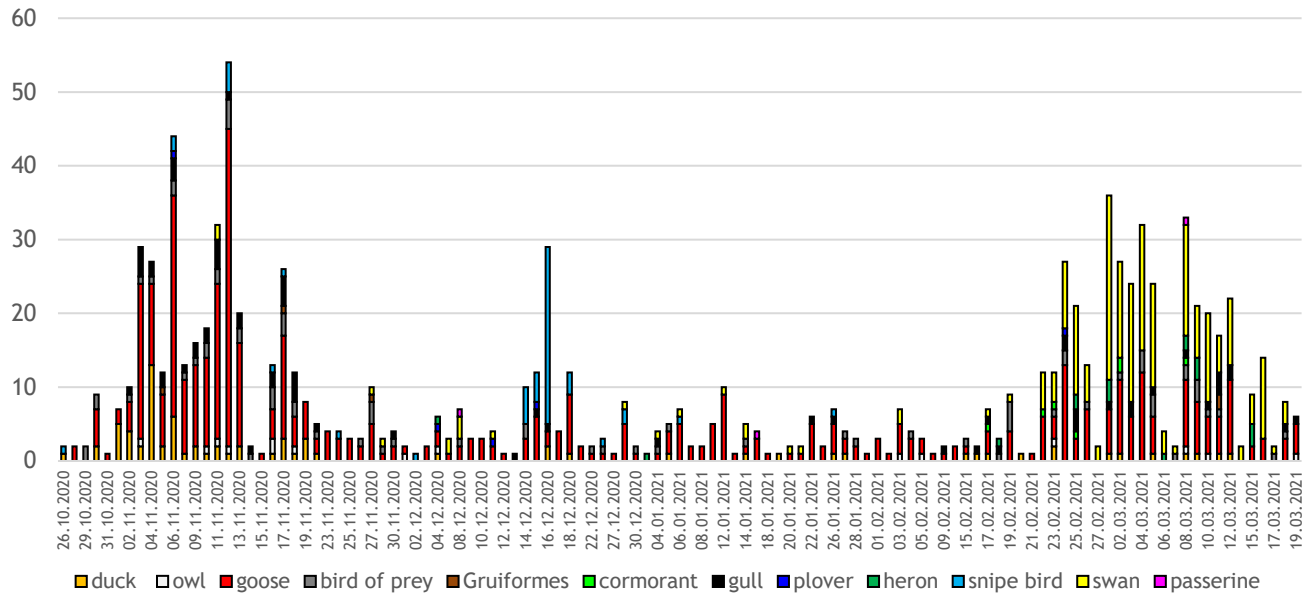

Figure 4: Chronological sequence of reported HPAIV H5 cases in wild birds by time of sampling, divided by bird group. Three waves can be identified: Wave 1: November 2020 predominantly in barnacle geese and wigeons; Wave 2: mid-December to end of December 2020 predominantly in red knots; Wave 3: since the end of February predominantly in swans and geese (Grey-lag and Canada geese) (status: 23.03.2021).

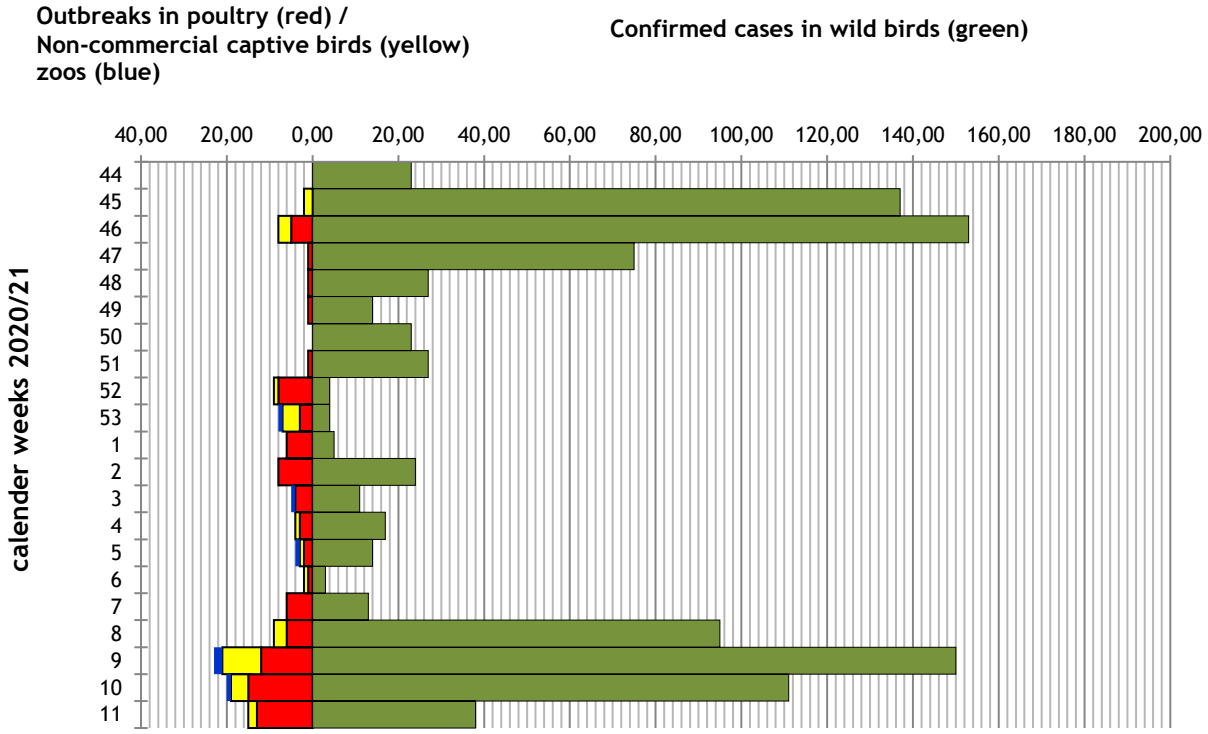

Figure 5*:* HPAIV H5 cases and outbreaks in poultry/captive birds on a weekly basis (date of sampling) between 26.10.2020 and 23.03.2021. Source: TSN.

Epidemiological situation in Europe (fig. 6, table 4)

Many European countries are reporting new cases of HPAI in poultry or wild birds on a daily basis; a total of 659 outbreaks in poultry, amounting to the loss of millions of birds, have been reported from 25 European countries. Since 22.02.2021, nine European countries reported a total of 80 new HPAI outbreaks and 18 European countries reported 286 new wild bird cases to the European Animal Disease Notification System (ADNS).

On March 15th 2021, the United Kingdom reported HPAIV H5N8 detection in one fox (*Vulpes vulpes*), four harbour seals (*Phoca vitulina*) and one grey seal (*Halichoerus grypus*), the latter having already been examined in December. The mammals showed pathomorphological changes that were suggestive of an acute systemic viral infection. A virus sequence comparison showed an almost identical homology with the viruses of mute swans, found sick, that had been taken to a wildlife sanctuary, to which the mammals had also been admitted and died there one week after the swans perished.

In France, 457 HPAI cases (subtype H5N8) have been detected in poultry farms as of Feb. 22, 2021, very predominantly in flocks of ducks (foie gras production) in southwestern France, where there is a very high density of these flocks. Drastic measures were implemented to stop the spread of disease, including the depopulation of all poultry farms within a 1-km radius and the slaughter of all ducks and free-range poultry within a 5-km radius of the index farm. Surveillance areas were extended to include a 20-km radius and movement ban was placed. The implemented measures seem to be working, as only 17 more outbreaks have been reported in ducks in the region in the past 30 days. Among only a few newly detected wild bird cases, one White stork and three sparrows were reported to be HPAIV H5N8 positive, in addition to an unknown number of swans.

Poland reported 29 new outbreaks in poultry (waterfowl, turkeys, chickens) and in a zoo in Warsaw since the end of February. A total of 49 wild bird reports include 96 HPAIV H5N8-positive wild birds that were found dead, mainly swans and isolated geese and buzzards.

The Netherlands reported 15 new wild bird cases since the end of February, predominantly HPAIV H5N8 (in Grey-lag, Barnacle and Canada geese, Cormorant, buzzard, Shelduck, Gadwall) but also HPAIV H5N1 (in gulls and Barnacle geese), and HPAIV H5N4 in one Curlew.

Belgium reported new HPAIV H5 cases in wild birds since the end of February (in Grey Heron, Barnacle Goose, Coot, Jay and one Wood Pigeon).

A high number of new wild bird cases (n=96) have been reported in Denmark since the end of February, with the highest number of cases identified in Whooper swans, Mute swans, geese, birds of prey, gulls and herons, all of which tested HPAIV H5N8 positive. Furthermore, 9 outbreaks have been confirmed in poultry (commercial turkey farms, hobby farms and birds in game reserves).

Sweden has reported 28 cases in wild birds since the end of February (Whooper and Mute swans, buzzards, Marsh harrier, Northern goshawks, Peregrine falcon, Kestrel, Eagle owl, Mallards, Jackdaws, gulls, Canada

geese, Bean geese). In addition, 13 outbreaks were reported in poultry, mainly laying hens, with losses of over 220,000 birds.

Norway reported eight cases of HPAIV H5N8 in Whooper and Mute swans and one Canada goose as of 22.02.2021.

In Italy, in addition to cases previously detected exclusively in wild birds, one outbreak occurred in a back-yard holding and another was recorded in a poultry unit.

Hungary reported HPAIV H5N8 in two Mute swans and HPAIV H5N5 in a White-tailed eagle since the end of February.

The Czech Republic reported new HPAIV H5N8 cases in 18 Mute swans and two wild ducks since 21.02.2021 and 9 HPAIV H5N8 outbreaks mainly in small village holdings and in two commercial duck holdings with a total of over 43,000 birds.

Romania reported on 25.02.2021one HPAIV H5N5 outbreak in a small village holding.

In Croatia, two swans found dead tested positive for HPAIV H5N8.

Since February 22nd 2021, both H5N8 and H5N5 virus infections have been detected in 14 Mute swans in Austria.

In Finland, 6 cases have been reported in wild birds (Mute swan, Mallard, gull) since the end of February.

In Latvia, since 22.02.2021, HPAIV H5N8 has been detected in 28 Mute Swans but also in one Mallard, one Scaup and one Goosander.

In Estonia, 17 HPAIV H5N8-positive swans, one Mallard and one Grey heron have been reported since 22.02.2021.

Lithuania also reported HPAIV H5 cases in four Mute swans since 22.02.2021.

The Ukraine reported 24 HPAIV H5 cases in Mute swans and one outbreak in a small village holding.

Table 4: Reports of HPAIV H5 outbreaks in captive birds and confirmed cases of HPAIV H5 in wild birds in Europe. Note: The numbers of wild birds are derived in parts from initial reports and present a section of data only. The number of wild birds with confirmed virus detection is much higher. Source: ADNS, OIE (date: 23.03.2021).

Country	HPAIV in wild birds	HPAIV outbreaks in poultry	HPAIV outbreaks in captive birds (zoo)	Total
FRANCE	16	481		497
ITALY	18	3		21
NETHERLANDS	67	11	11	89
BELGIUM	25	2	1	28
UNITED KINGDOM	121	19	2	142
IRELAND	27	1		28
DENMARK	235	11	2	248
SPAIN	3			3
AUSTRIA	28			28
FINLAND	10	1		11
NORWAY	20		1	21
SWEDEN	42	15	5	62
CZECH REPUBLIC	19	15		34
ESTONIA	18	1		19
HUNGARY	3	6		9
POLAND	73	72	1	146
SLOVENIA	6			6
BULGARIA		4		4
LATVIA	36			36
LITHUANIA	8	1		9
ROMANIA	7	2		9
SLOVAKIA	5	1	1	7
CROATIA	2	1		3
SWITZERLAND	2			2
UKRAINE	2	14		16
Total	**766**	**659**	**24**	**1449**

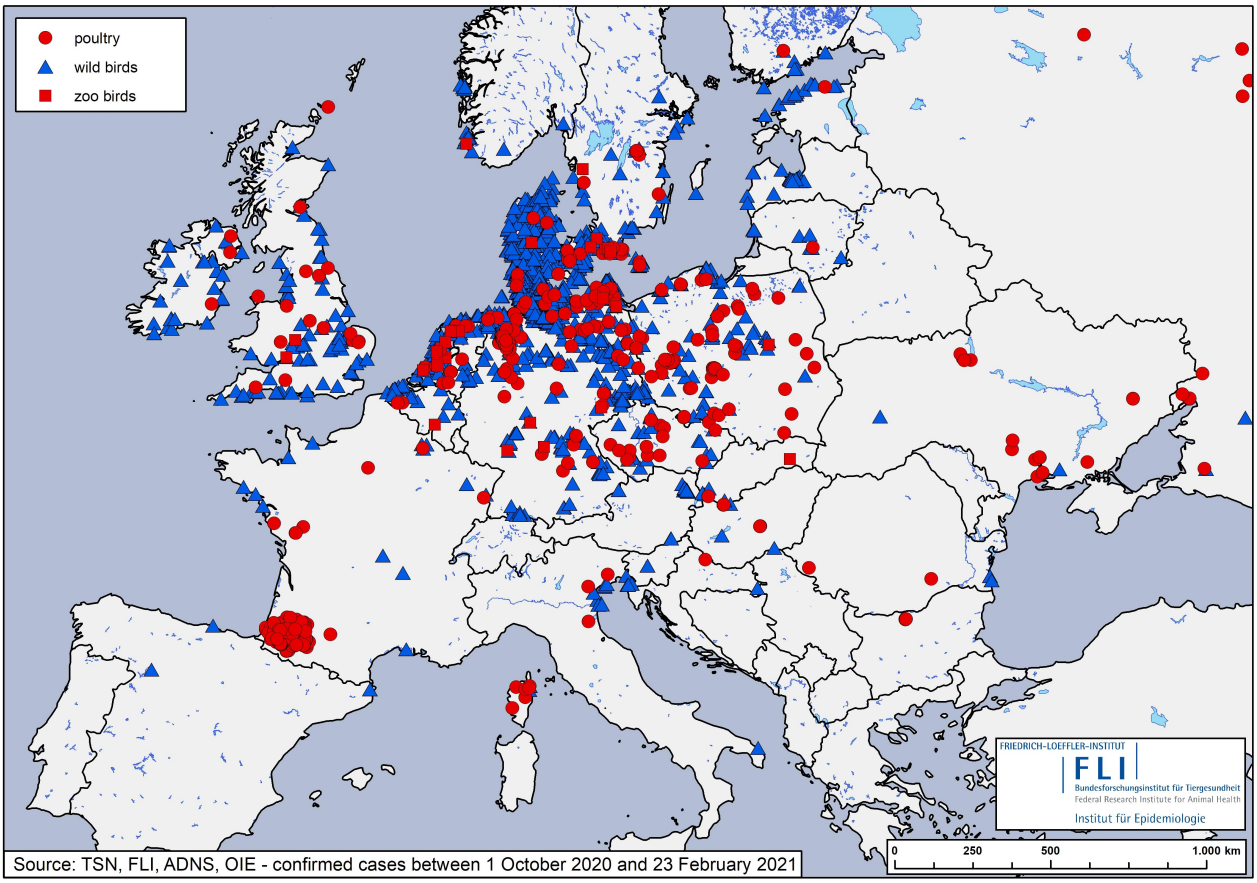

Figure **6**: HPAIV H5 outbreaks in poultry, captive birds and cases in wild birds in Europe reported to ADNS, OIE and TSN since 01 October 2020. (Date: 23.03.2021). See legend for symbols.

Assessment of the situation

An active HPAIV H5 outbreak in the summer of 2020 in southern Siberia and neighbouring northern Kazakhstan had already led to initial concerns that HPAI H5 viruses could reach Europe through the autumn migration. In the past, several such outbreaks have coincided spatio-temporally in line with the autumn migration of water birds, leading to the spread of viruses in Europe and Africa.

Subsequently, HPAI H5 could be confirmed from October 2020 onwards; numerous HPAIV H5-positive wild birds were identified in the Netherlands, Germany, the United Kingdom, Ireland, Denmark, Belgium, Sweden, Norway, Finland, Lithuania, Latvia, Estonia - mainly along the coasts - and has continued to spread to the southern and south-eastern parts of Europe to the Czech Republic, Austria, Switzerland, Hungary, Bulgaria, Romania. Since the end of February, a second peak was recorded regarding the number of outbreaks in poultry and cases in wild birds (currently mainly swans and geese). Germany's current epidemic exceeds the dimension of 2016/2017 and it is still mounting.

Phylogenetic studies of the HPAI H5 viruses suggest a new entry. Although the viruses analysed so far belong to clade 2.3.4.4b, like the HPAIV H5N8 introduced since 2016, they are not directly phylogenetically linked to the H5N8 viruses that caused outbreaks in Europe in the first half of 2020. Instead, the analysed viruses

have a new genetic signature that show similarities to several viruses from Eurasia in recent years. For the H5N8 viruses, the available full genome sequences show a possible entry from western or central Asia as early as spring/summer 2020 via neighbouring regions of the Russian Federation. The H5N5 viruses show a similar genetic background but with reassortant NA5 and PA segments. These show similarities to NA5 viruses from the Russian Federation, as well as LPAI viruses from Eurasia in 2018, indicating that the current virus strain allows for clustered genetic reassortment (e.g., H5N5, H5N1, H5N3, H5N4), similar to 2016/17.

On Nov. 16, an outbreak in captive birds was reported in southern Europe (Corsica). Subsequently, Italy, Spain, Croatia, Slovenia, Poland, Slovakia, Hungary, Lithuania, Romania, the Czech Republic, Bulgaria and Finland also reported outbreaks in poultry. Regionally sporadic outbreaks in fattening ducks in southern France and turkey farms in Germany appear to reflect disease spread scenarios similar to those in 2017, when secondary virus transmission between neighbouring flocks was considered a likely factor in spread.

Regarding HPAIV, there is always the potential for a change in virus characteristics, including host range. Equally, sporadic transmissions to humans can occur, especially in cases of high viral loads as could be expected in affected poultry farms. For example, on Feb. 19, 2021, Russian authorities announced that infections with HPAIV of the H5N8 subtype clade 2.3.4.4B had been detected for the very first time in seven employees of a poultry-fattening farm. The infections took place as early as December 2020, and, according to the authorities, the affected workers did not show symptoms. Sporadic spillover of HPAIV H5 virus into mammals has also been reported in the UK, where one fox, one grey seal and four harbour seals were affected by HPAIV H5N8 infection. No further spread (human to human) was observed. Despite the current, extensive outbreaks in poultry and cases in wild birds, there is to date no evidence that humans have been infected and no natural infections in mammals have occurred in Germany.

POULTRY and CAPTIVE BIRDS in Germany

In Germany, 133 outbreaks have occurred so far in poultry, including captive birds in zoological facilities. Wherever there are potential contacts between wild birds and domestic poultry, especially waterfowl, infections can be introduced and new sources of infection can emerge unless an escape of virus from affected flocks can be prevented. Virus-contaminated material (footwear, vehicles, objects, litter) is considered the most likely source of infection. Poultry farms that share and move litter or other materials or tools, or even batches of birds, between units are particularly at risk.

Between Dec. 21, 2020, and Jan. 16, 2021, a series of 18 HPAI H5 outbreaks occurred in turkeys (mostly fatteners) and one in ducks in the district of Cloppenburg, a region with high poultry density. The sources of infection are unknown. However, the full genome sequences of the viruses from the affected holdings are almost identical, so that secondary spread between the flocks can be assumed.

Another series of outbreaks relating to HPAIV H5N8 occurred since the end of February in the district of Cloppenburg that recorded 18 outbreaks, including 16 turkey fattening farms. According to TSN reports, a total of 1.6 million birds have been affected since the beginning of the epidemic in 2020/2021; in Lower Saxony alone, the number of birds in affected farms has reached one million. Spread of infection is also possible across the federal states, and especially likely if poultry are traded. Currently, there are a number

of HPAI outbreaks and suspicions of disease in poultry in Baden-Württemberg and Thuringia that could indicate such a spread.

WILD BIRDS

Similar to the HPAIV H5N8 event in 2016/2017, increased mortality is now observed predominantly in waterfowl and bird species that also feed on carrion, e.g. various raptors, owls and gulls. The range of species affected is similar across Europe. Exceedingly high mortality rates were observed in barnacle geese, wigeons and red knots in the Schleswig-Holstein Wadden Sea National Park in December 2020. The situation there has calmed down in the meantime. Deceased and infected birds of prey, gulls and owls are indicators of a localized outbreak in the area. Multiple findings of HPAIV H5-positive droppings of mallards, teals and wigeons highlight that ducks can excrete the virus without becoming visibly ill or dying. Since the end of February, many European countries have been reporting increased detection of HPAIV H5 in swans.

Infected but asymptomatic wild birds or those incubating the disease can be seen as mobile virus carriers that have the potential to spread the virus further. Many waterfowl species (e.g. geese, swans, some duck species) move between farmland (especially grassland, maize stubble and winter rapeseed and cereal crops), where they feed during the day, and resting waters, which they visit in the evening and at night. They can excrete the virus via their droppings and contaminate the land and water that they visit. In addition, sick and dead waterfowl that may be predated by mammals such as foxes and martens, but also birds of prey and crows may lead to considerable environmental contamination on arable and grazing land in cases where high viral loads exist. Further indirect spread of virus through people or vehicles entering such areas can lead to the introduction of the virus into poultry farms.

Low temperatures in winter stabilize the infectivity of influenza viruses in the environment. When waterfowl congregate in high numbers, virus transmission and spread between wild bird species is facilitated. Due to the fact that not all wild waterfowl can be fully surveilled, the actual spread of HPAI H5 viruses can only be estimated via sporadic case identifications. It must be assumed that the viruses continue to spread in wild birds in Germany, possibly without a noticeable increase in mortality.

The cold arctic air since the beginning of February has caused snow and ice in northern and central Germany and more dynamic bird movements can be expected as many water bird species seek out ice-free waters. Under such weather conditions, the infection of wild birds may spread inland and further into southern and western Europe. Swans seem to be particularly frequently affected at present and conspicuous regarding their high HPAIV-related mortality.

The spring migration of northern water birds is currently underway. There are strong migratory movements within Europe from western and south-western to eastern and north-eastern directions (geese, swans, ducks, divers), which could continue to spread HPAI viruses supra-regionally.

Risk assessment and recommendations

The large amount of positive HPAI H5 cases identified in waterfowl, raptors, owls and shorebirds, as well as the introduction of the virus into poultry farms in coastal regions of the North Sea and Baltic Sea, can be attributed temporally and spatially to the autumn migration of waterfowl. The distribution of the virus continues unabated. Outbreaks in poultry are currently occurring in large parts of Germany. The number of secondary outbreaks has increased. In north-west Germany, the high density of poultry farms in some areas, combined with inadequate biosecurity measures, are likely to play a significant role. Equally ongoing trade in live poultry is likely to contribute to disease spread. HPAIV H5 may also be transmitted via affected poultry to wild bird populations.

Weather fluctuations and further migratory movement of water birds will favor virus transmission and spread. Deceased and infected wild birds are ingested by scavengers, which subsequently contribute to virus spread within their geography and thus add to environmental viral contamination. This also increases the risk of indirect entry routes into poultry farms.

The risk of HPAI H5 viruses spreading to waterfowl populations within Germany and Europe is high.

The risk of HPAI H5 virus incursions into German poultry holdings and bird populations in zoological institutions through direct and indirect contacts with wild birds is also considered high, especially in holdings close to waterfowl resting and wild bird gathering areas, including farmland where wild waterfowl gather.

At present, there is a high risk of virus spread between holdings (secondary outbreaks). A high density of poultry and live poultry trade pose particularly high risks.

For waterfowl farms, the risk of undetected circulation of HPAI H5 virus and subsequent spread between poultry flocks is also considered high.

The highest priority is to protect farmed birds from HPAI H5 incursions and the associated risk of further spread of HPAIV infections. To this end, the recommended biosecurity measures and surveillance activities must be reviewed and consistently adhered to. Poultry farmers are legally obliged to comply with basic biosecurity rules. In addition, the establishment of a functioning physical barrier between wild waterfowl habitats (e.g. bodies of water, fields where geese, ducks or swans congregate) and poultry holdings is essential. Housing poultry and other biosecurity measures minimize the risk of direct and indirect contact with infected wild birds. Particular focus must be placed on the prevention of virus introduction via contaminated feed, water or contaminated litter and equipment (footwear, wheelbarrows, vehicles, etc.). Virus spread between poultry holdings must be avoided. To this end, strict biosecurity measures must be taken, including continuous cleaning and disinfection of clothing, shoes, equipment and vehicles.

Sick or dead wild birds should be reported without delay to the veterinary authorities for safe removal and examination. Documentation of affected species should, where possible, be carried out in close cooperation with the nature conservation authorities in order to evaluate the occurrence of disease in relation to the occurrence and movements of bird populations. Prompt removal and safe disposal is important to prevent

chains of infection from carrion-eating birds. Prevention and biosecurity measures in zoos and poultry farms, especially those with outdoor and free-range systems, should be urgently reviewed and, if necessary, optimized.

Specifically, the following recommendations are made:

- Review the feasibility of the measures prescribed as part of contingency plans in the event of an epidemic and update the plans as necessary.
- Prevent or effectively monitor the sale of live poultry to avoid the spread of HPAI nationally.
- Personnel caring for poultry should work exclusively on one farm.
- Veterinarians and other people who visit poultry flocks on a professional basis should refrain from undertaking further visits and observe the 48 hours grace period if they have entered a flock in which clinical signs, including increased mortalities, are suggestive of HPAI.
- Due to the recent report of HPAIV infections (H5N8) in humans in Russia, it is recommended that anyone coming into close contact with infected poultry, for example staff during catching and killing duties, should look out for respiratory symptoms and/or conjunctivitis for at least 10 days. If symptoms occur, the advice is to seek immediate medical attention and initiate testing. In addition, general hygiene rules apply. Dead birds should not be handled without the use of personal protective equipment; hands should be washed thoroughly with soap and water if contact has occurred. Anyone exposed to prolonged contact with infected birds should consider the use of antiviral medications as a prophylactic measure. The Robert Koch Institute provides a number of recommendations (German version only) at the following link: https://www.rki.de/DE/Content/InfAZ/Z/ZoonotischeInfluenza/Empfehlungen_1.pdf
  https://www.rki.de/DE/Content/InfAZ/Z/ZoonotischeInfluenza/Monitoring_exponierter_Personen_bei_Ausbruch_von_aviaerer_Influenza.html
- Increased virological surveillance waterfowl holdings and early testing of sick birds as well as fallen stock in order to identify HPAI infections as early as possible.
- Avoid the sharing of any equipment between holdings, including carcass bins, and vehicles.
- Restrict vehicle access and personnel on poultry farms.
- Ensure risk-based housing of free-range poultry (at least around HPAIV H5 detection sites).
    - Poultry flocks that have been excluded from a housing order should be clinically and virologically tested at a maximum interval of 3 weeks.
- Where possible, house all birds kept in zoos, restrict access to bird houses/bird shows in risk areas. Bodies of water in zoos should be drained or covered with flutter tape to detract wild ducks.
- Minimize direct and indirect contact between poultry and wild waterfowl and natural water bodies (e.g., cover ponds on premises, etc.).
- Restrict the hunting of waterfowl in affected areas so as not to flush out potentially infected animals.
- Hunters and persons who have come into contact with wild birds should not enter poultry buildings for the next 48 hours.

- Review, optimize and consistently implement the correct biosecurity measures in poultry facilities, including the use of available guidelines, e.g. DEFRA (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/953018/biosecurity-poultry-guide.pdf)
  Ensure the implementation of minimum biosecurity measures in small holdings, zoological gardens, animal parks and shelters in accordance with the Avian Influenza Protection Order.
- Ensure increased vigilance for rapid detection of suspected cases in poultry and seek diagnostic clarification without delay.
- Ensure intensification of passive and active wild bird monitoring with emphasis on waterfowl and birds of prey:
  - We ask the public to report observations of abnormal behaviour in waterfowl (e.g. head and neck twisting) but also report fallen wild birds to the veterinary authorities as soon as possible in order to accelerate early detection.
  - Dead birds should be collected immediately and sampled for the presence of Influenza-A infection at the state wildlife investigation offices. The birds should then safely disposed of to avoid environmental contamination or further transmission via carrion-eating birds. At least one swab per geographic area should be taken from each bird species during random testing. All deceased birds should be documented by species, age, and location of their finding.
  - Observations in bird sanctuaries can be particularly helpful: targeted examination of waterfowl (e.g., white-fronted geese, whistling ducks) faeces should also be considered to assess local risk.

Further guidance:
The European Food Safety Authority (EFSA) provides an overview regarding the Avian Influenza situation in Europe/EEA and the UK at the following link:
https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2021.6497