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Addressing H5N1 Highly Pathogenic

Avian Influenza *Qualitative risk assessment on spread in the Central African region*

Issue no. 4



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Though bordering Cameroon, Nigeria was, therefore, not included in the assessment given that the virus is already present there.

The qualitative assessment is based on information available as of 15 September 2016 and will be revised as circumstances change.

The reader should also note that the **uncertainty in the assessment of the different levels of likelihood remains high**, since there is need for a better understanding of the poultry sector at local, national and regional levels as well as poultry movement patterns and related issues to provide a more precise assessment.

Poultry-related activities in Cameroon and the Central African Region

Central African Economic and Monetary Community (CEMAC) countries hold 87 million heads of poultry with family farming representing 70 percent of the total regional production (Logtene, 2009) and acting as a pillar to aid economic growth as per the objectives set in the Regional Economic Programme (World Trade Organization (WTO), 2013). Poor economic integration in the region (low official regional trade) leads to higher trade of frozen poultry meat and eggs from the Federative Republic of Brazil, the People's Republic of China, the European Union and the United States of America (Kamuanga *et al.*, 2008; Agritrade, 2013). The need to rely on international imports for some African countries undermines regional poultry production development because imported meat from these countries is cheaper than local meat.

In Cameroon, poultry production accounts for most of the national livestock production, with more than 70 percent occurring in backyard farming. Poultry meat production represents around 53 percent of Cameroon's total meat production (estimated to be 295 275 tonnes) (see Annexes

1. BACKGROUND

Following H5N1 highly pathogenic avian influenza (HPAI) outbreaks in the Republic of Cameroon in May and September 2016, the Food and Agriculture Organization of the United Nations (FAO) prepared a qualitative assessment in order to evaluate the risks of the introduction of the virus into neighbouring countries with Cameroon that have so far not reported occurrence of the disease through poultry movements and trade relations (i.e. the Central African Republic, the Republic of Chad, the Republic of the Congo, the Republic of Equatorial Guinea and the Gabonese Republic¹). The Federal Republic of Nigeria has been affected by H5N1 HPAI outbreaks in poultry since December 2014 and circulation of the virus is considered to be endemic.

¹ Cameroon, the Central African Republic, Chad, the Congo, Equatorial Guinea and Gabon are part of the Economic Community of Central African States (ECCAS) and Economic and Monetary Community of Central Africa (CEMAC). Both organizations promote free movement of goods and people among Member States.

OUTPUTS

Qualitative risk assessment on H5N1 HPAI spread considering poultry movements and trade relations of Cameroon with neighbouring countries on 9 September 2016

The conclusions of this assessment are presented here:

- 1 The likelihood of **introduction** of H5N1 HPAI from Cameroon into previously unaffected countries in the Central African Region through **live adult poultry trade** from Cameroon is considered:
 - **negligible** through **legal** trade with Equatorial Guinea and Gabon;
 - **low** through **legal** trade with the Central African Republic, Chad and the Congo;
 - **moderate** through **illegal** trade with neighbouring countries, especially between Cameroon and Chad.
- 2 The likelihood of introduction of H5N1 HPAI from Cameroon into unaffected countries in the region through day-old chicks trade, considering the negligible risk of these animals in the spread of H5N1 HPAI, but the low risk of the virus being spread through fomites (e.g. crates and trucks used for transporting day-old chicks) is, overall, considered to be low. The likelihood of H5N1 HPAI introduction into previously unaffected countries in the Central African Region through egg trade from Cameroon is considered very low.
- 3 The likelihood of H5N1 HPAI **introduction**, regardless of virus survival in those products, into previously unaffected countries in the Central African Region through **trade with other poultry products** from Cameroon is considered **negligible**.

- 4 The likelihood of H5N1 HPAI **introduction** into previously unaffected countries in the Central African Region through **wild bird movements or trade** from Cameroon is considered:
 - **very low** for wild bird migration.
 There is insufficient information to assess the risk from wild bird hunting and trade, or meat consumption.
- 5 The likelihood of H5N1 HPAI **introduction** into previously unaffected countries in the Central African Region through **fomites** from Cameroon is considered:
 - **moderate** to Chad due to the informal commerce between both countries;
 - **low** to the Congo, Equatorial Guinea and Gabon;
 - **very low** to the Central African Republic that relies on imports from European Union.
- 6 Considering the different regions in Cameroon, the likelihood of H5N1 HPAI **spreading** into unaffected areas is considered:
 - **high** for the **Littoral** due to the neighbouring infected regions and significant poultry activities;
 - **moderate** for the **Far North** that has a high poultry density and shares borders with Nigeria which presents a high circulation of the virus;
 - **low** for the East, North, North-West and South-West regions.
- 7 The likelihood of H5N1 HPAI **spreading** into unaffected areas in Cameroon is considered:
 - **high** for **live poultry markets, backyard production systems and started chicks**;
 - **high** for **legal national trade** between infected regions and the Littoral (previously not affected);
 - **low** for **industrial farms**.

2 and 3). Egg production is concentrated in the West Region of the country, which accounts for 80 percent of the national production, followed by the Littoral (5.6 percent) and South Regions (5.3 percent).

The production systems in the country are divided into: (i) industrial farms that are concentrated around the three main metropolises (Douala, Yaoundé and Bafoussam) (see Annex 4); (ii) commercial small-scale farms, mainly broiler production, including occasional farms engaged in temporary production for demands related to festivities at the beginning and the end of the year; and (iii) backyard farming.

Cameroon's recent H5N1 HPAI outbreak in Yaoundé in May 2016

On 23 May, the LANAVET (National Veterinary Laboratory) Yaoundé branch confirmed the first H5N1 HPAI outbreak in Cameroon since the previous introduction in 2006 (three outbreaks in the North and Extreme North regions of the country). The infected site was a breeder farm belonging to the complexe avicole modern (CAM) of Mvog-Betsi, where more than half of the 33 000 chickens died. At the same time, mortality in several markets of Yaoundé had been reported. The source of the outbreak is unknown (World Organisation for Animal Health (OIE), 2016) but the Yaoundé farm is unlikely to be considered the index outbreak. Informal trade of infected birds or movement of wild, migratory birds were considered as possible routes of introduction.

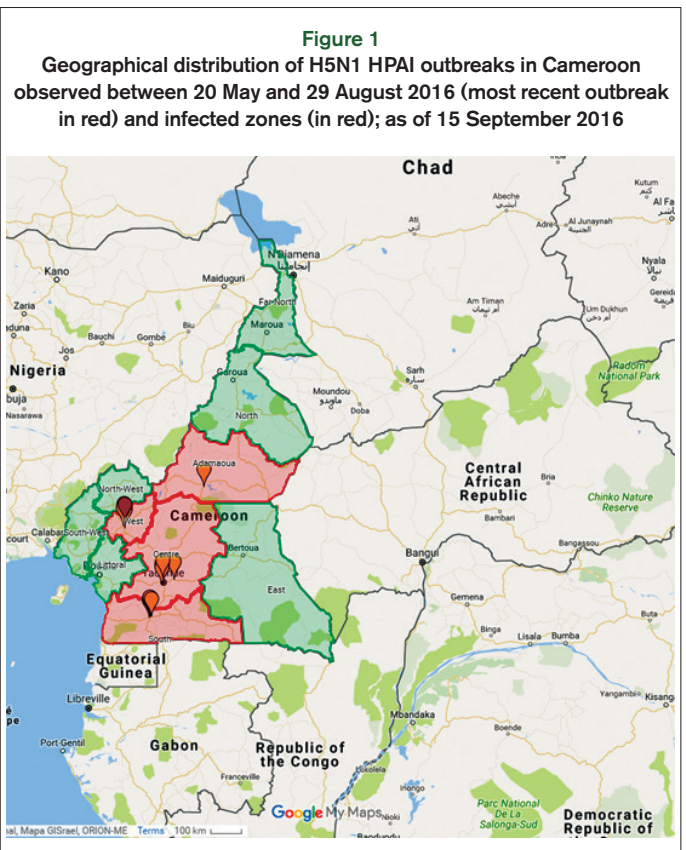
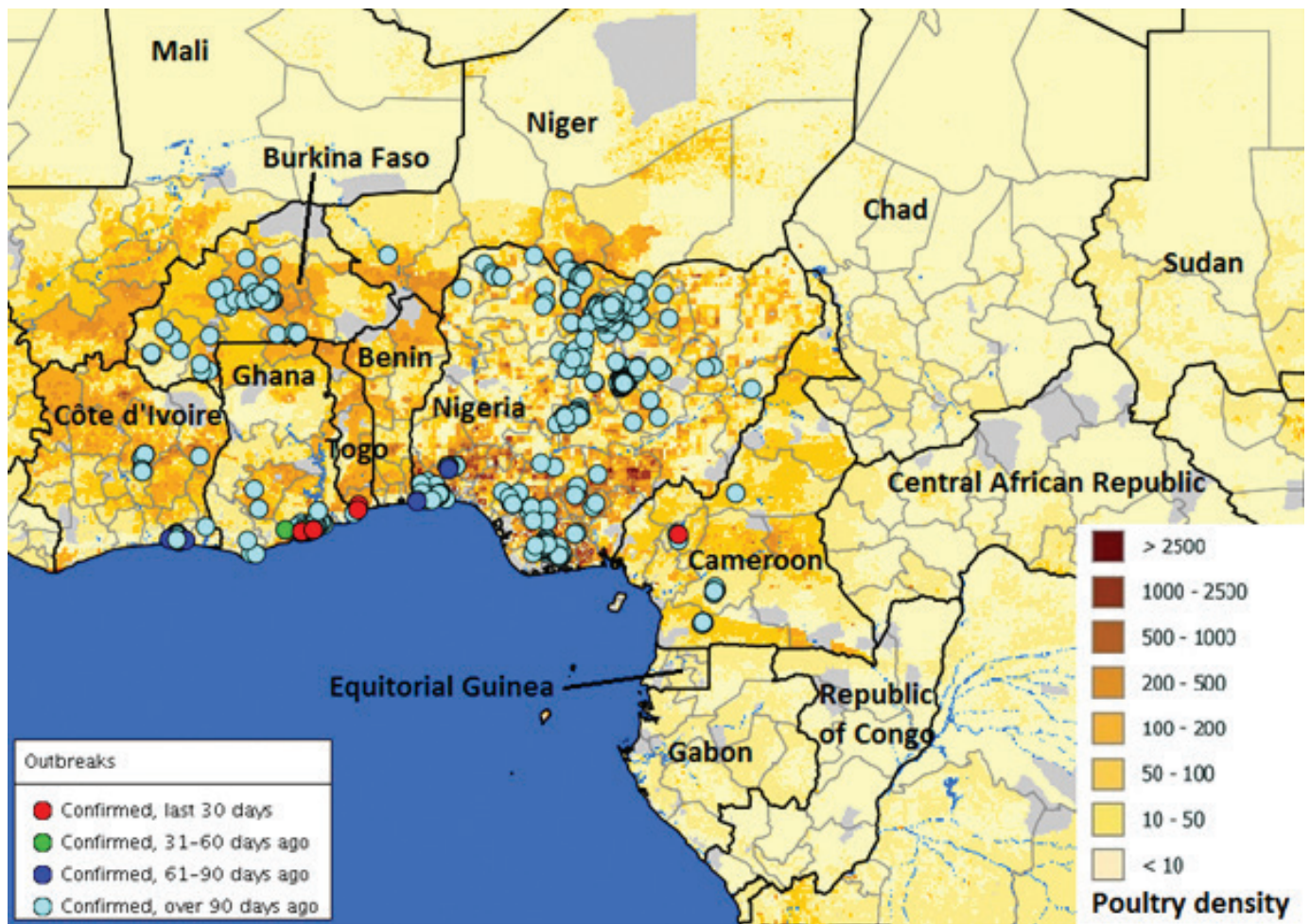


Figure 2

Location of confirmed H5N1 outbreaks in West and Central Africa, by onset date, 1 December 2014 to 15 September 2016, over the poultry density



Source: FAO Global Early Warning System (GLEWS) – Global Animal Disease Information System (EMPRES-i)

After this outbreak, several other sites were found to be infected, following spontaneous reports of mortality and traceback activities during outbreak investigations. One farm and one market in Yaoundé (Centre) and one market in Ebolowa (South) tested positive on 31 May; three farms in Yaoundé including one annex of the CAM Mvog-Betsi (where chickens did not show any clinical signs), one farm in Ebolowa, two markets in Bafoussam and Bandjoun (West) and one farm in Bayangam (West) tested positive on 1 June; and one farm in Soa (Centre), one farm in Djerem (Adamaoua) and one farm in Ebolowa tested positive on 10 and 11 June. No further outbreaks had been reported until, on 29 August 2016, H5N1 HPAI affected 2 628 birds in Nzemgouen (West) and a total of 31 772 birds had to be destroyed as a disease control measure. The affected bird population included breeders (ranging from 15 to 51 weeks old) and commercial layers (1 week old). Surveillance for avian influenza is being reinforced.

Outbreaks in the West Region are particularly worrisome due to the high poultry density and the high-value birds that are produced there, as this area is where most of the large breeder and layer farms of the country are located. Yaoundé and Douala (Littoral) are also of concern because they have a high concentration of commercial poultry farms (mainly broiler producing) and important live poultry markets, with the most important market of the Economic Community of Central African States (ECCAS) zone located in Mvog Ada.

To identify the clade of the virus and genetic similarity with other circulating viruses (such as those in Western Africa), genome sequencing is required. Samples from the different infected sites were, therefore, sent to Istituto Zooprofilattico Sperimentale delle Venezie, the OIE/FAO Reference Laboratory for Avian Influenza in Padova, Italy, for confirmatory diagnosis and further characterization of the virus. The H5N1 virus circulating in Cameroon was confirmed to be of the 2.3.2.1c clade which is the same that was detected in Burkina Faso, the Republic of Côte d'Ivoire, the Republic of Ghana, the Republic of the Niger and Nigeria.

In an attempt to control disease spread, all 22 live poultry markets were closed and not only those that tested positive for infection. Infected farms were quarantined and some disease control measures, i.e. culling, were implemented at night to avoid public concern. Over one million eggs had to be burnt along with carcasses, manure and other infected materials. Farmer meetings were held in affected areas to raise awareness of preventive measures to be taken and the necessary procedures needed to reduce the risk of virus introduction into farms, including the proper use of personal protective equipment (PPE). Gabon and Equatorial Guinea banned the import of poultry and their products from Cameroon. Therefore, large numbers of live chicken and other domestic birds were stockpiling at Kiossi (southern border).



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2. MAIN RISK QUESTIONS ADDRESSED

QUESTION 1. What is the probability of H5N1 HPAI introduction from Cameroon into previously unaffected countries in the Central African Region through:

a) Live poultry trade (day-old chicks and adult poultry)?

- From live poultry trade

Considering that:

- “Porous” borders due to the free movement of people and goods promoted by regional economic communities facilitate the uncontrolled movement of people and animals, including illegal trade of poultry or poultry products. It is difficult to quantify or control exchange between villages and cities close to the borders, especially between Cameroon and Chad (from Maroua to Kousseri) (Ichakou, 2015).
- Due to the outbreak in Cameroon, Equatorial Guinea and Gabon closed the border and banned legal importation of live poultry and poultry products. These bans are reinforced at borders of infected regions in Cameroon.
- For the Congo, there is no information available on trade with Cameroon. Trade arrangements with other bordering countries (Cameroon not included) are mentioned, but in the context of fish and smoked fish products (WTO, 2013).
- Nigeria and Cameroon are the two main regional hubs for livestock production, including poultry, and Cameroon belongs to ECCAS and CEMAC. Despite the fact that Cameroon and the Central African Republic are not part of the Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union

(UEMOA), with respect to poultry movements both are considered to belong to the same commercial region,² along with the Republic of Benin, Chad, the Niger and Nigeria (Kamuanga *et al.*, 2008). The flux of live animals is usually from Cameroon and the Central African Republic to Nigeria. Less significant routes (in numbers) include Cameroon to Gabon and the Central African Republic to Congo.

- From day-old chicks

Considering that:

- Due to the outbreak in Cameroon, Gabon and Equatorial Guinea closed the border and banned legal importation of live poultry.
- Legal exports of eggs and **day-old chicks** are directed from Cameroon to neighbouring countries (Gabon, Equatorial Guinea and the Congo) (Logtene and Awa, 2009). An official report provided by FAO (Ichakou, 2015) states that the Congo receives day-old chicks from Cameroon.
- The Central African Republic and Chad import day-old chicks from Cameroon which are transported by train or trucks (Ichakou, 2015).
- When commercially produced, day-old chicks do not represent a risk for H5N1 HPAI infection. However, infection can occur later through contact with contaminated surfaces and fomites during transport (Sims and Narrod, 2007).

The likelihood of **introduction** of H5N1 HPAI from Cameroon into previously unaffected countries in the Central African Region

² Three main regions of commercial exchange are recognized by Western Africa: (i) Cabo Verde, the Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal, Sierra Leone and Liberia; (ii) Burkina Faso, Côte-d'Ivoire, Ghana, Mali and Togo; (iii) the Republic of Benin, Cameroon, Chad, the Niger and Nigeria.

through **live adult poultry trade** from Cameroon is considered to be:

- » **negligible**³ through **legal** trade with Equatorial Guinea and Gabon;
- » **low** through **legal** trade with the Central African Republic, Chad and the Congo;
- » **moderate** through **illegal** trade with neighbouring countries, especially between Cameroon and Chad.

The likelihood of **introduction** of H5N1 HPAI from Cameroon into unaffected countries in the region through **day-old chick trade** is considered to be **low**, given the negligible risk of these animals in the spread of H5N1 HPAI and the **low** risk of the virus being spread through fomites (e.g. crates and trucks used for transporting day-old chicks).

b) Eggs?

Considering that:

- Eggs from infected hens can harbor H5N1 HPAI virus. However, considering general malformation of infected eggs and the fact that HPAI-infected hens are either too sick to produce eggs or die quickly, it is unlikely that infected eggs will be found in the market chain (Sims and Narrod, 2007).

The likelihood of H5N1 HPAI **introduction** into previously unaffected countries in the Central African Region through the **egg trade** from Cameroon is considered to be **very low**.

c) Other poultry products (frozen chicken, feathers)?

Considering that:

- These products do not enter into the poultry production chain, but go directly to human consumption.

The likelihood of H5N1 HPAI **introduction**, regardless of virus survival in those products, into previously unaffected countries in the Central African Region through **trade of other poultry products** from Cameroon is considered **negligible**.

d) Wild birds?

Considering that:

- It is widely recognized that trade-related activities constitute the most important risk factor for local and cross-border spread of HPAI in poultry, but that wild birds have a role to play in long-distance spread; for example, from Asia to Europe, North America and Africa.
- At this period of the year wild bird migration movements are not expected. There is currently no epidemiological evidence relating migratory wild birds to the outbreak.
- There is no evidence of the virus circulating in wild bird populations in Cameroon. Given the presence of the virus in the poultry production systems of Cameroon, a spill-over of the virus to wild birds cannot be excluded.
- Small-scale and traditional farms are exposed to wild fauna due to lack of infrastructure or implementation of biosecurity measures (Ichakou, 2015).
- Synanthropic species such as pigeons, corvids and passerines frequenting poultry holdings, as well as predator species that can become infected while scavenging on poultry carcasses or preying upon infected and sick wild birds, should be given a priority.

- There is no specific information available for Cameroon regarding wild bird movements, by trade or along migratory routes, or wild bird meat consumption. This represents a gap in the current assessment.
- In Nigeria:
 - » the virus circulates at high levels owing to the endemic situation in the country;
 - » wild bird migration and informal trade of wild birds are a suspected means of transmission (FAO, 2015).

The likelihood of H5N1 HPAI **introduction** into previously unaffected countries in the Central African Region through **wild bird movements or trade** from Cameroon is considered to be **very low** for wild bird migration. The available information is insufficient to assess the risk from wild bird hunting and trade, or meat consumption.

e) Fomites?

Considering that:

- No disinfection process is applied to trucks and no special outfit is required for the drivers transporting eggs and day-old chicks (no booth baths or wheel dips are in place) both for legal and illegal trade (Ichakou, 2015).
- Chad relies on significant imports from Cameroon, Nigeria and the European Union to supply the national demand in eggs (Reounodji, 2007).
- There is informal commerce of eggs and day-old chicks from Cameroon to Chad (Logtene and Awa, 2009).
- The Central African Republic and Gabon rely on egg imports from the European Union (Tsubou, 2008. Guinza, 2007).
- Egg collection and transport presents contamination risks, especially if these steps do not foresee hygienic measures such as disinfection. Also, traceability of imported eggs and local production in Cameroon is not sufficiently applied (Ichakou, 2015).
- Legal exports from Cameroon are directed to neighbouring countries (the Congo, Gabon and Equatorial Guinea) especially for eggs and day-old chicks (Logtene and Awa, 2009). The main origin of these products are commercial farms where higher biosecurity and hygiene standards generally exist (Ichakou, 2015).
- When commercially produced, day-old chicks do not represent a risk for H5N1 HPAI infection. However, infection can occur later through contact with contaminated surfaces and fomites during transport (Sims and Narrod, 2007).

The likelihood of H5N1 HPAI **introduction** into previously unaffected countries in the Central African Region through **fomites** from Cameroon is considered to be:

- » **moderate** for Chad due to the informal commerce between both countries;
- » **low** for Equatorial Guinea, Gabon and the Congo;
- » **very low** for the Central African Republic that relies on imports from the European Union.

QUESTION 2. What is the likelihood of H5N1 HPAI spreading into unaffected areas of Cameroon?

Considering that:

- On a national level, it is possible to trace some of the existing commercial patterns in Cameroon (Ngandeu, 2007):
 - » Live poultry is routed from small villages located in the Far North Region or other distant regions to concentrate

³ Levels of likelihood are defined as follows (from highest to lowest levels): high (highly likely to occur), moderate (potentially occurring), low (unlikely to occur), very low (very unlikely to occur), negligible (extremely unlikely to occur) and nil (not occurring).



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in Maroua market in the Northern Region. Yaoundé and Douala also receive animals from The Far North. This region also has the biggest traditional poultry production (i.e. backyard farming) in the country; more specifically, in the Mayo Danai and Mayo Kani departments, and in the Dziguiliao and Gobo markets.

- » Poultry and eggs from Bafoussam area go to major cities, mainly Douala and Yaoundé.
- » Eggs from the Southern Regions go to the Northern Regions.
- Areas with the highest human population density (Centre, Littoral and Far North) match with two of the areas that are characterized by high poultry density and the importance of poultry-related activities (see Annex 3) (Ichakou, 2015).
- Backyard production accounts for 85 percent of the total poultry production in Cameroon. However, this production system is characterized by decreased productivity, frequent predator attacks, lack of infrastructure, under-nutrition of animals and high incidence of pathologies, since biosecurity measures are rarely or insufficiently applied (Ichakou, 2015).
- Backyard farms are distributed over the whole country, especially in remote areas. The primary destinations of products are rural and urban areas in close vicinity (Ichakou, 2015).
- Industrial farms are concentrated in Douala, Yaoundé and Bafoussam. Industrial production is the only system that receives veterinary assistance (i.e. vaccination against common poultry diseases, consultancy and intervention in the case of production losses) and applies biosecurity measures. Small commercial farms (including temporary farms that develop poultry production for a special season of the year, to supply local demand) and traditional poultry production do not maintain a close relationship with the

Ministry of Livestock, Fisheries and Animal Industry and its veterinary services (Ichakou, 2015).

- Live poultry markets play a major role in the local poultry value chain due to sourcing and congregation of animals from many different locations (e.g. various farms from different geographic areas and productions systems with varying biosecurity levels). Close contact of these birds increase the risk of virus transmission.
- Live poultry markets generally have very poor biosecurity in place. Their infrastructure often renders cleaning and disinfection very difficult or inefficient (soil flooring, wooden cages and tables, etc.).
- After the recent outbreak in Cameroon, markets in Yaoundé, Ebolowa, Bandjoun and Bafoussam were closed.
- Yaoundé has a total of 22 live poultry markets (personal communication) that have been closed following the first reported outbreak. Discussions are ongoing about opening a pilot market to allow for sanitary destocking of farms while following strict biosecurity measures.
- The risk of HPAI virus spreading is increased if people move from farm to farm (i.e. veterinary teams implementing control measures); people or fomites (trucks, equipment, etc.) can act as vectors for virus introduction into non-infected farms if cleaning and disinfection are not applied properly (Halvorson, 2002).
- Disinfection protocols are rarely applied on (Ichakou, 2015):
 - » parental farms when receiving successive batches;
 - » trucks and crates for transporting eggs and day-old chicks (no booth baths or wheel dips).
- Started chicks are a production system similar to backyard farming when it comes to biosecurity. These temporary farms raise day-old chicks for 10 to 20 days and re-sell the juvenile chicks to farmers (Ichakou, 2015). Yaoundé

and Douala are the two main regions with this type of production and it usually increases by the end of the year because of local festivities.

- Ramadan (June 2016) has greatly increased demand for poultry and poultry products, particularly in the extreme north of the country.
- Active surveillance has not been implemented in the country yet.
- Increased demand combined with a live bird trade ban in infected areas creates strong economic incentives for traders to smuggle birds from infected to non-infected areas. The government has implemented strict movement control, but some trucks are known to circulate at night, avoiding controls.
- Nigeria has been continuously reporting new outbreaks since December 2014 (EMPRES-i) and, considering that it shares borders with Cameroon, it is possible for the virus to be imported into currently unaffected zones in Cameroon.
- The Centre, the South, the West and Adamaoua regions are already affected.

Taking into account the different regions in Cameroon, the likelihood of H5N1 HPAI spreading into unaffected areas is considered to be:

- » **high** for the **Littoral** due to the neighbouring infected regions and the significant poultry activities;
- » **moderate** to the **Far North** that has a high poultry density and shares borders with Nigeria which presents a high circulation of the virus;
- » **low** for the East, North, North-West and South-West regions.

The likelihood of H5N1 HPAI spreading into unaffected areas in Cameroon is considered to be:

- » **high** for **live poultry markets, backyard productions systems and started chicks**;
- » **high** for **legal national trade** between infected regions and the Littoral (previously not affected);
- » **low** for **industrial farms**.

3. CONSEQUENCE ASSESSMENT

The risk of H5N1 HPAI introduction into previously unaffected Central African countries or Cameroonian regions through trade of poultry or poultry products represents a major concern on national and regional scales in terms of animal health and food security. To control outbreaks, poultry on affected and in-contact farms are being culled and farms have to follow a 21-day restocking period as per OIE regulations. To limit further spread of the disease, quarantine of holdings as well as trade bans are established which may compromise availability of poultry products.

With the information accessible to date, only a broad assessment of consequences in terms of food security can be presented. Ideally, this assessment should be further elaborated as soon as local socio-economic and value chain data become available.

So far, no human cases of this zoonotic virus were reported in West and Central Africa. Generally, humans become infected with the H5N1 virus through close contact with infected poultry and may present with severe respiratory disease, sometimes leading to respiratory failure and death. Even if sustained human-to-human infection was not evidenced in countries where human cases occurred, limited human-to-human transmission can still happen in family settings where relatives take care of the sick.

The H5N1 HPAI virus was assessed to have pandemic potential which makes it an international public health threat.

4. MEASURES TO BE CONSIDERED TO REDUCE THE RISK

The following measures should be considered to reduce the likelihood of introduction of H5N1 HPAI into **unaffected countries**:

- Recommendations at country level:
 - » Be aware of a likely increase in illegal trade or animal movements following a ban of poultry and poultry products; illegal trade/movements will be impossible to control and this issue needs to be considered and addressed.
 - » Increase border controls to reduce illegal trade and control official trade.
 - » Focus disease control measures on the poultry product trade, particularly, the egg trade, and on the transmission through fomite. Cleaning and disinfection of fomites, such as trucks and crates, should be considered rather than implementation of a total egg trade ban.
 - » Review and assess the level of preparedness, including national contingency plans for HPAI and identify a list of immediate needs as well as a budget for outbreak control.
 - » Increase surveillance efforts for the early detection of H5N1 HPAI and other influenza viruses, particularly in live bird markets and at border points.
 - » Review and assess the diagnostic capabilities for laboratory analysis of H5N1 HPAI, including laboratory procedures, appropriate equipment and supplies;
 - » Review, assess and increase risk communication and awareness strategies to all different publics (i.e. technical people, farmers, consumers, hunters, private sector).
 - » Increase and sustain coordination and information sharing between countries in the region.
 - » Discuss options for disease control, including compensation for culled birds, and budget for this.
 - » Evaluate technical capacity development needs particularly in regard to good husbandry practices that contribute to the prevention of HPAI.
 - » Establish an appropriate mechanism and strategy to ensure sustainable resources, both national or external, for HPAI prevention and control programmes;
 - » Consider gathering and quantifying information on trade and poultry movements at the national and international levels.
 - » Enhance the role of the private sector and poultry trader associations in the prevention of HPAI through good biosecurity and husbandry practices, interacting with government officials in the prevention and control of HPAI.
 - » Update the available data and enhance data collection regarding technical and statistical information at national and international levels to decrease data gaps.
- Recommendations for people in contact with poultry:
 - » Practice good biosecurity measures:
 - Keep wild birds away from poultry and keep different types of bird and species of animal apart. Screens, fencing or nets can be used to separate species and help prevent virus transmission.



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- Keep poultry areas clean and free of excess manure and other waste. Use separate clothes and boots/shoes when working with your birds. Do not wear these items to other places. Shower after coming into contact with other birds before working with your own birds.
- Wash hands often to kill and remove the virus. Hand washing should always be done after handling birds, cooking or preparing poultry products, and before eating.
- » Monitor the animal's health status and report sick or dead animals to the local veterinary (or public health) authorities. If this is not possible, inform neighbours or community leaders. It is important that all signs of illness or sudden and unexplained deaths in poultry, farmed birds, wild birds or other animals are reported to the authorities so that they can deal with them safely and help stop the virus spreading. It is important to keep the sick birds isolated.
- » Ensure that wildlife authorities report mortality events in the coastal and inland wetlands where large congregations of water birds are known to occur.
- » Avoid consumption of sick or dead poultry and do not give or sell them to others. Such animals should also not be fed to other animals.
- » Eat only well-cooked poultry products.
- » Seek immediate advice from your doctor if you are sick and show signs of fever after being in contact with poultry, farmed birds, wild birds or other animals.

Similar measures could reduce the likelihood of the spread of H5N1 HPAI into **unaffected Cameroonian regions**:

- Consider implementation of the practices outlined in "Recommendations for people in contact with poultry".
- Practise active and passive surveillance.

- Increase biosecurity measures in the entire production chain, considering different steps of the production (including transport) through communication, providing information to farmers and workers.
- Reinforce veterinary services (public sector) relationships and activities, as well as support to small-scale and backyard farms.
- Increase awareness and involvement of the private sector.
- Propose compensation strategies to farmers.
- Reinforce passive surveillance in wild birds, especially in synanthropic species.
- Conduct proper field disease investigation procedures and the measures required to manage the risks for poultry and human populations, including biosecurity.

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ANNEXES

ANNEX 1. EVOLUTION OF POULTRY POPULATION IN CAMEROON FROM 2010 TO 2014

Year	Poultry population
2010	70 176 806
2011	65 286 625
2012	66 592 358
2013	72 758 691
2014	74 213 865

Source: Adapted from Ichakou, 2015

ANNEX 2. EVOLUTION OF POULTRY MEAT PRODUCTION (IN TONNES) IN CAMEROON FROM 2010 TO 2014

Year	Poultry meat production (tonnes)
2010	97 144
2011	102 219
2012	107 292
2013	119 053
2014	126 378

Source: Adapted from Ichakou, 2015

ANNEX 3. EVOLUTION OF POULTRY MEAT PRODUCTION (IN TONNES) PER REGION IN CAMEROON IN 2014

Region	Poultry meat production (tonnes)
Adamaoua	1 015
Centre	25 637
East	4 657
Far North	2 038
Littoral	36 268
North	1 355
North-West	7 657
West	28 672
South	733
South-West	18 346
NATIONAL	126

Source: Adapted from Ichakou, 2015

ANNEX 4. POULTRY POPULATION PER REGION IN CAMEROON IN 2016 (CITIES WITH MORE THAN 150 000 HABITANTS)

City	Poultry population	Region
Douala	1 338 082	Littoral
Yaoundé	1 299 369	Centre
Garoua	436 899	North
Kousséri	435 547	Extreme North
Bamenda	393 835	North West
Maroua	319 941	Extreme North
Bafoussam	290 768	West
Mokolo	275 239	Far North
Ngaoundéré	231 357	Adamaoua
Bertoua	218 111	East
Edéa	203 149	Littoral
Loum	177 429	Littoral
Kumba	144 268	South West

Source: Unpublished CMC-AH Cameroon mission report (2016)

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The Emergency Prevention System (EMPRES) is an FAO programme, founded in 1994, with the goal of enhancing world food security, fighting transboundary animal and plant pests and diseases and reducing the adverse impact of food safety threats. EMPRES-Animal Health is the component dealing with the prevention and control of transboundary animal diseases (TADs).

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