EMPRES WATCH
emergency prevention systems

Updated situation of Highly Pathogenic Avian Influenza (H5N1) in Asia

1. Summary findings

Highly Pathogenic Avian Influenza (HPAI) type H5N1 continues to spread in Asia. In addition to the 10 countries affected in the South East Asia (2003 - 2004), India, Pakistan, Myanmar and Afghanistan were newly affected by new outbreaks of HPAI in 2006 in poultry and wild birds.

More than 200 million birds were culled as a consequence of HPAI outbreaks in Asia with enormous impact for food security and people's livelihoods, poultry farms with unproductive "downtime" after outbreaks which have resulted in negative effects in poultry farms, backyard poultry farms and on international trade of live poultry and poultry products. Public health issues and contact with HPAI H5N1 contaminated environments remain a concern.

China, Cambodia, Laos, Malaysia and Thailand reported new outbreaks of HPAI during 2006.

Table of Contents

Although there is an increase in knowledge and public awareness on HPAI in poultry, it is not clear yet what is the exact role of wild birds in the epidemiology of HPAI, the susceptibility of wild bird species, the mechanisms underlying virus persistence and virus transmission between wild migratory wild birds, resident wild birds, free range birds and domestic poultry populations.

In Asia, two sources of infection of HPAI virus are likely to be coexisting. The introduction and transmission of HPAI virus and circulation of the virus in domestic poultry populations particularly backyard farms, live bird markets and commercial poultry farms with *low biosecurity systems* and risks through migratory wild birds. The link between the domestic poultry compartment and wild bird habitats and the true risk posed is still unclear.

2. HPAI in wild birds

This document reviews the ongoing situation of HPAI in Asia, its expansion in the first semester of 2006 and explores the potential risks of a re-emergence of HPAI in wild birds and poultry populations in Asia. The international community and nations of the region should evaluate their resources and strategies to curb the incidence of H5N1 in poultry.

The role of wild birds in the spread of avian influenza across large geographic distances, among countries, or even inter-continentally, still remains unresolved. While it is acknowledged that wild birds may play a role, it is unclear whether H5N1 is endemic in wild birds that make long migratory flights. If H5N1 is endemic in wild bird species, and if they periodically or continually shed the virus as they make long distance movements, it would serve as one explanation for the geographical expansion of the disease. Alternatively, wild birds may become infected from poultry sources prior to migrating long distances, thus carrying the virus and

spreading it as they migrate. The mechanisms by which wild birds could be infected prior to migration include: 1) scavenging or exposure to disposed infected eggs, poultry products, or carcasses in the environment; 2) exposure to infected faecal material as fertilizer or through drains that receive wastes from poultry farms that open into streams and wetlands; 3) introduction of infected faeces into wetlands as run-off from rivers or streams; or 4) via other wild birds that serve as "bridge species", connecting infected poultry farms to wild habitat by visiting farms where feed is plentiful, and then spending time in more natural habitats; 5) where open farming of ducks in rice fields introduce infected faeces into the wetland and whose habitats are shared by wild birds. Alternatively, wild birds may migrate prior to being exposed to H5N1, and when they arrive at their resting site may be exposed to the virus through any of the mechanisms described above; and possibly further spread the virus around locally. These are some of the questions that remain regarding the transmission and ecology of this infectious disease.To date, FAO and its partners (CIRAD and Wetlands International) have tested approximately 5,000 healthy wild bird samples (mostly ducks and waders) and have found none to be positive for H5N1. If this disease was endemic in wild birds and had a high prevalence, one would have expected a at least a few samples to have tested positive. This season, FAO is committed to further support efforts of its partners, and other wildlife surveillance programs (GAINS; http://www.gains.org) in an attempt to capture thousands of additional wild birds for sampling to determine their status. After this next round of sampling, scientists will have a better indication into whether this particular strain of AI virus may be endemic in certain wildlife species.

Table 1. Wild bird species found dead in HPAI outbreaks in Qinghai Province, China

2005	2006
bar-headed goose (*Anser indicus*) ruddy shelduck (*Tadorna ferruginea*) brown-headed gull (*Larus brunnicephalus*) great black-headed gull (*Larus ichthyaetus*) great cormorant (*Phalacrocorax carbo*)	bar-headed goose (*Anser indicus*) ruddy shelduck (*Tadorna ferruginea*) brown-headed gull (*Larus brunnicephalus*) cormorant (*Phalacrocorax sp*.) common tern (*Sterna hirundo*) grebes (*Podiceps* sp.) Chinese egret (*Egretta eulophotes* common merganser (*Mergus merganser*) great white egret (*Casmerodius albus*) Eurasian wigeon (*Anas penelope*) black-necked cranes (*Grus nigricollis*) owls crows grassland vulture condors[1]* hawks

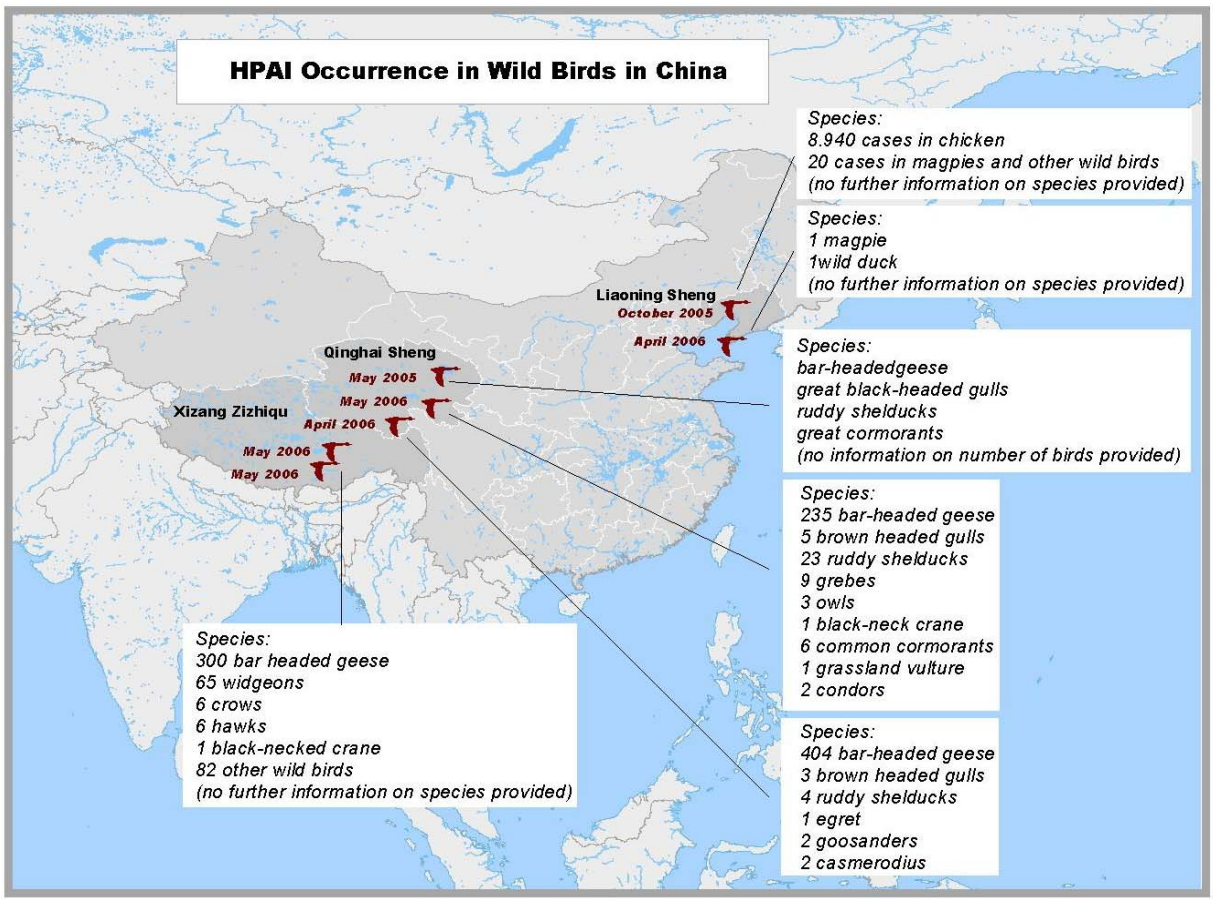
source: OIE (http://www.oie.int/downld/AVIAN%20INFLUENZA/A_AI-Asia.htm)

1 There are no condors in Asia. This specific example demonstrates the need to improve reporting that occurs from the member countries to OIE. It is possible that this is a mistake in reporting; a mistake in translation of species names; or possibly a captive condor that was reported as a wild bird. In all cases, reports should include common names, genus, and species. It is also important to quantify the exact number of individuals of each species since this data is ultimately used to determine whether a few individuals were affected or whether a population can serve as a virus reservoir.

At this stage, we know that most wild birds that have tested positive for H5N1 are birds which were sick, moribund or were dead. This suggests that some individuals of these species of wild birds were very susceptible to H5N1, and that surveillance efforts should focus on apparently healthy birds from these species to determine if other individuals resist becoming sick, migrate, shed the virus as they migrate, and ultimately develop immunity. An additional focus of surveillance activities should be directed at understanding whether "bridge species" serve as the potential H5N1 virus link between domestic and migratory wild birds. Of particular interest are the species of wild bird that are non-migratory, such as Eurasian Tree Sparrow *Passer montanus*, magpies and crows (*Corvus spp.*), as these species may serve as the mechanism by which H5N1 over winters in cold habitats. If these bridge species could harbour the disease from one season to the next, and highly susceptible migrants intermingle with bridge species habitats for the first time during early migration, deaths of wild birds may appear to be the first deaths observed in an area, the erroneous interpretation could be placed on migratory birds for bringing the disease into the new location. However, the disease may actually have already been there and harboured in non-migratory "bridge species", or in domestic poultry, or in the aquatic environment that maintain viability of the virus through the cold winter.

In 2004, China reported approximately 50 outbreaks of HPAI only in poultry, between January and June. During the second part of 2004 no outbreaks were reported. In May-June 2005, some 6,500 migratory birds were reported dead in Qinghai Lake Nature Reserve in Qinghai Province, China. The species affected included bar-headed goose, great black-headed gull, brown-headed gull, ruddy shelduck and great cormorant (Table 1). According to BirdLife International (www.birdlife.org), bar-headed geese usually arrive at Qinghai Lake for breeding in mid-March, followed by great cormorant, ruddy

Figure 1. Spatial distribution and species recovered from wild bird HPAI cases in 2005 and 2006 (Each circle represents one known outbreak per region)

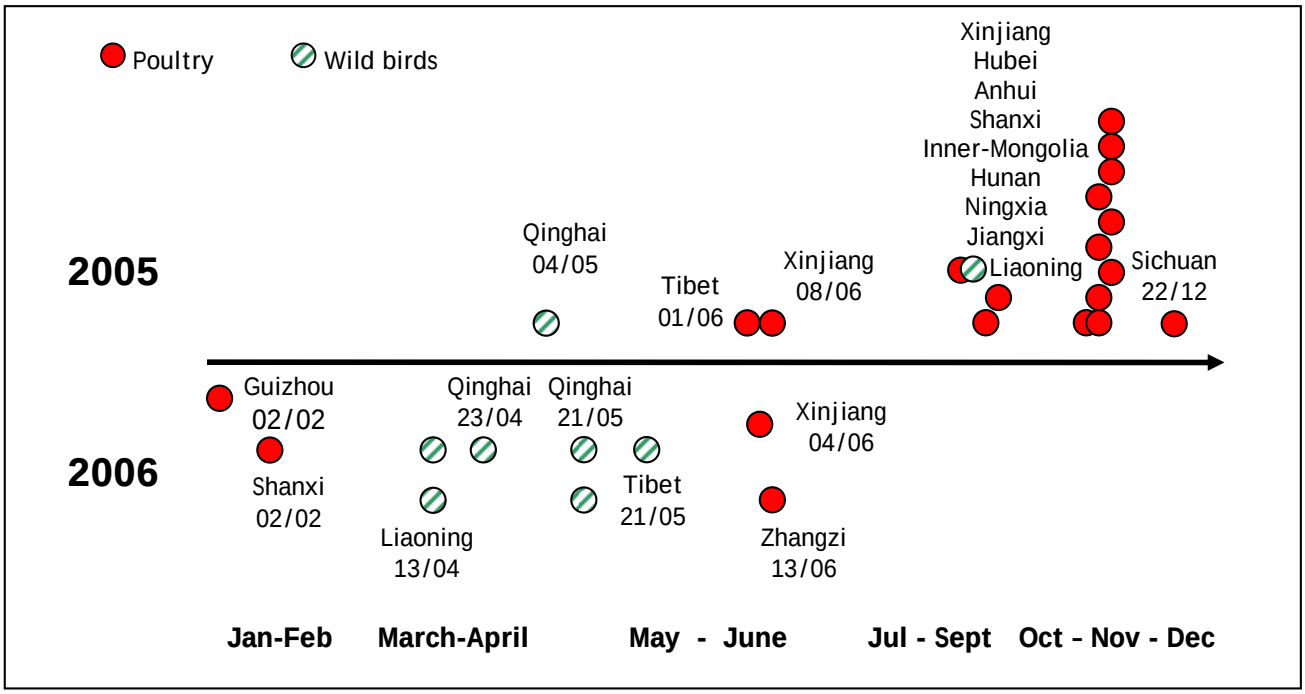


shelduck, great black-headed gull and brown-headed gull. The HPAI outbreak in Qinghai in 2005 occurred after the arrival of this species to Qinghai Lake area from the south but it is not possible to determine whether migrating birds brought the disease or whether the disease may have already been present in the environment, in other local non-migratory wild bird species, or in poultry, duck, or goose producing farms (either before or after birds were depopulated from these farms).

Bar-headed geese started showing signs of the disease in late April 2005 and the first deaths were reported in early May 2005. If wild birds carried the disease as they migrated, one would also have expected them to succumb to the disease soon after arriving in the region as their body condition is poorest immediately after migration, and not 4-6 weeks after arrival, when they would have had time to gain body mass, improve their condition, and otherwise recuperate from the stress of migration. Other possible explanations for this mortality event is that H5N1 was present in poultry or other farm raised species, or was reintroduced to previously depopulated farms by restocking of birds, and upon arrival to the region, bridge species carried the diseases from the agricultural locations to wild birds. Unfortunately, without better information on wild bird movements and poultry practices in the region, and without improved surveillance, it is not possible to know the true reason for the emergence and movement of the disease in this part of China. FAO investigations in and around Qinghai Lake Nature Reserve did not identify poultry production farms or households that could account for this introduction; nor did these preliminary investigations identify farms that were raising bar-headed geese for commercial purposes.

Interestingly, the major wildlife mortality event subsided by mid to late May 2005, and H5N1 remained problematic in poultry from June through February of 2006, with major outbreaks being documented in 10 provinces towards the end of 2005 (November/December), a time when migratory birds had departed for wintering grounds in late August or September, and no incoming migratory birds would be expected to arrive until March the following year, at the earliest. Approximately 20 wild birds (magpies and other wild birds) were reported to have died from H5N1 during the poultry outbreak in Liaoning in October 2005 according to the OIE reports (Figure 2). Magpies (a potential bridge species), which may not have been migratory, could serve a link between poultry rearing farms and wildlife habitats.

Figure 2. Timeline of HPAI outbreaks in poultry and cases in wild birds in China 2005-2006

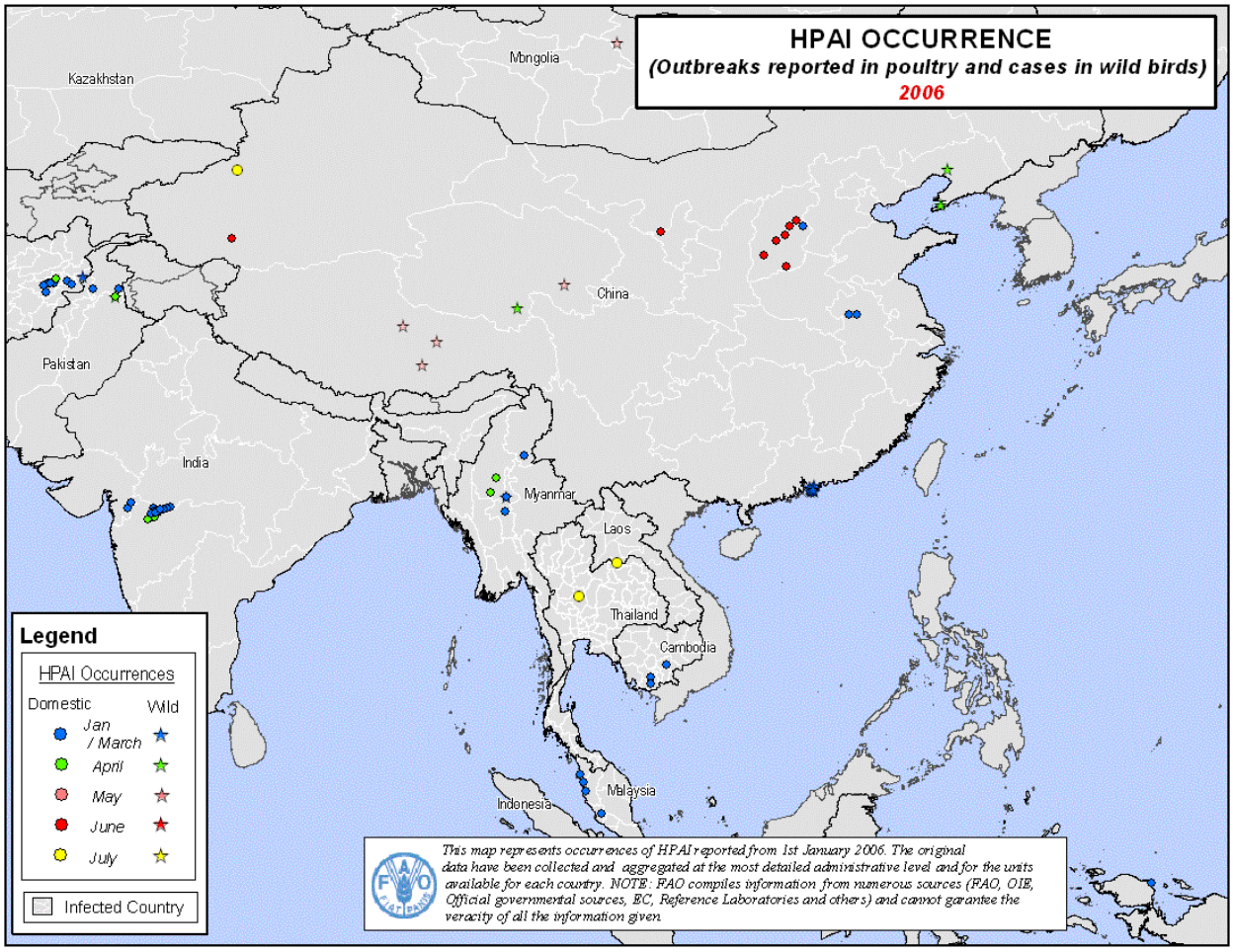


The first wildlife mortality events of 2006 were recorded on 13 April in Jinzhou and Panjin, Liaoning Province. A magpie and individual duck were found dead (species not known) and H5N1 isolated. These cases in wild birds occurred only five months after a poultry outbreak occurred in Jinzhou and, again, it is not clear whether migratory birds carried the disease to this location, or were affected by the disease when they arrived. The use of vaccines at poultry farms was also implemented in November 2005 and vaccine programmes undertaken in commercial poultry farms that do not practice high level biosecurity measures may also need to be considered as another factor in understanding disease transmission dynamics from poultry to wildlife or vice versa.

Two weeks after the wild bird (no species information provided by China to OIE) cases were observed in Liaoning, 423 wild birds were found dead in Yushu county (~2,000 km away and further west), Qinghai Province. Almost 90% of these cases were bar-headed geese. Since Liaoning lies to the east of the known concentrations of bar-headed geese and there are no reported movements of this species to Qinghai, it is highly unlikely that sick (or healthy virus shedding) bar-headed geese would have migrated from Liaoning to Qinghai Province.

On 21 May 2006, 285 wild birds were found dead in Goulou District (yellow dot in Figure 3), Qinghai Province and 1,145 in Nagqu (~200 km from each other and thus some overlap of habitat use may be occurring amongst birds from these 2 locations; and about 2,000 - 2,500 km from Liaoning) in Tibet (Figure 3). In these wildlife mortality events, a high proportion of mortalities were also bar-headed geese. Although we do not currently know whether bar-headed geese actually played a role in actively transporting the H5N1 HPAI virus into and out of China, we do know that this species serves as an early warning indicator species. Undoubtedly, some (and possibly most or all) individuals of this species, are highly susceptible to H5N1

Figure 3. Temporal distribution of HPAI outbreaks in domestic and cases in wild birds in 2006



resulting in mortality[2]. However, it is very important to collect additional information before conclusions are drawn about the role that this highly visible species could play in the transport, movement, dispersal, and spread of H5N1. We must understand whether this disease is endemic in these species (i.e. healthy birds have been exposed, survived, develop immunity, and can serve as potential shedders), seeding a trail of H5N1 virus as they migrate from Pakistan, India, Nepal, Bangladesh and Myanmar, across the Himalayas, and into China, even though there were no reported deaths of this species in any of these countries to date.

3. HPAI in domestic poultry

In China, two new outbreaks of HPAI were confirmed in poultry farms in Xinjiang and Zhangzi Provinces in June 2006 (Figure 3). Myanmar for the first time reported outbreaks of HPAI type H5N1 in Mandalay and Sagaing Provinces in February, March and April 2006. These outbreaks affected only poultry farms.

Table 2 summarises the situation of countries in Asia and the dates of first and last outbreak reported in countries affected by HPAI.

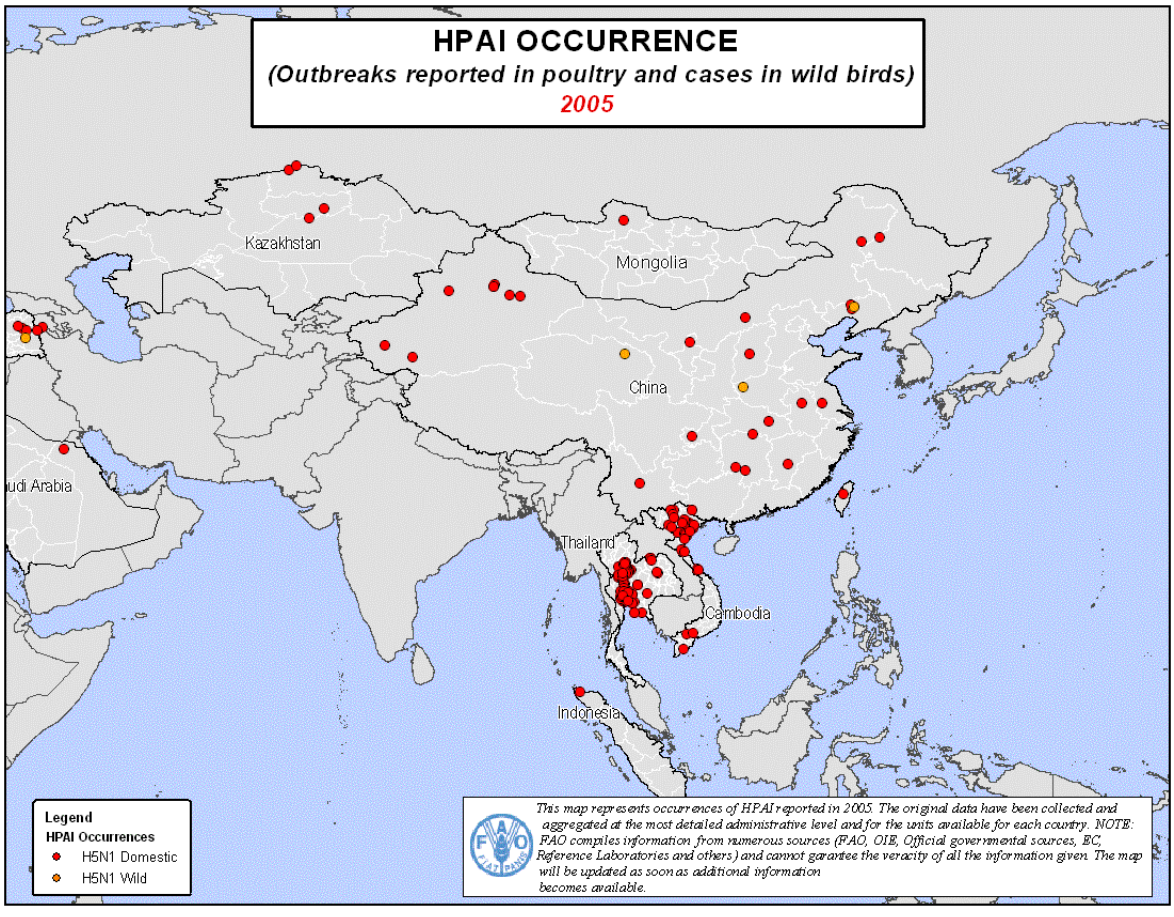
Table 2: Outbreaks of HPAI in Asia

Country	No of outbreaks	Date of start of the	
		first outbreak	last outbreak
Vietnam	2,312	27/12/2004	17/12/2005
Indonesia	211	11/12/2003	March 2006
China	85	23/01/2004	26/06/2006
Korea	19	11/12/2003	21/03/2004
Myanmar	80	09/03/2006	25/04/2006
Japan	7	12/01/2004	01/03/2004
Laos*	1	14/01/2004	14/01/2004
Cambodia	16	11/01/2004	30/03/2006
Malaysia	15	07/08/2004	22/03/2006
Thailand	1,079	19/01/2004	16/07/2005
Pakistan	12	23/02/2006	20/04/2006
India	7	27/01/2006	18/04/2006
Afghanistan	13	02/03/2006	19/03/2006

source: www.oie.int (accessed on 31 July 2006)
*new outbreak of HPAI H5N1 confirmed on 28 July

In India, two poultry outbreaks were confirmed in February 2006, on the West coast. The farms affected were commercial layer farms with very poor biosecurity. The area of the initial reported outbreak

Figure 4. HPAI outbreaks in poultry and wild birds in Asia in 2005



(Nawapur), Maharashtra State is near an important water body where small numbers of migratory birds also arrive but no surveillance appears to have been done in that area. The surrounding area had a large number of farms located in the vicinity to this wetland.

The first suspicion of HPAI in Pakistan was observed on the 24 February 2006. Subsequently there were two confirmed outbreaks of HPAI H5N1 on 27 February in poultry (Figure 4). Following Pakistan, Afghanistan reported the occurrence of HPAI outbreaks. One case was found in a crow on 19 March. The first outbreak occurred close to the border with Pakistan. The same day, cases were found in Kabul, about 200 kilometres far from the first confirmed outbreak.

The poor biosecurity in some poultry farms, illegal poultry trade across borders and the lack of active surveillance in wild birds makes it difficult to date to determine the origin of the infection in these three newly affected countries in 2006 (Afghanistan, India and Pakistan).

4. Early detection of HPAI outbreaks

The period between the observation of clinical signs in poultry and the confirmation of HPAI is an important parameter to evaluate the progress made by affected countries on disease early detection and response.

Table 3 shows the progress of early detection in two waves of HPAI outbreaks in Asia between 2004 and 2005-2006. Since the beginning of the epidemic, early detection of HPAI has improved in Asia and veterinary services are now more aware of the importance of early detection and official reporting. Early detection and timely response allowed countries such as Malaysia, Japan and Korea (Republic of) to swiftly eradicate the virus after introduction. In countries of Asia with delayed detection and response the virus is likely to continue to be circulating.

Table 3: Early detection of outbreaks in selected countries

Country	Time period elapsed between observation and confirmation (days)	
	2004	2005 - 2006
Cambodia	22.7 (n=18)	7.3 (n=7)
China	7.0 (n=130)	4.7 (n=52)
Malaysia	no outbreaks	4.3 (n=10)
Vietnam	39.3 (n=82)	20.2 (n=99)
Japan	2.4 (n=9)	no outbreaks
Korea (Republic of)	2.4 (n=22)	no outbreaks

Source: FAO-Empres i

In Indonesia, three new human cases of HPAI were confirmed in April-May 2006. The investigation conducted by provincial health authorities found a history of one contact with sick and dying chickens in one case in the week before the onset of her symptoms (www.who.int). This suggests that HPAI virus infection was circulating. Of the 52 cases confirmed to date in Indonesia, 40 were fatal (WHO). Illegal movement of birds such as fighting cocks was indicated as a source of infection for HPAI outbreaks in poultry reported in April 2006.

5. Early Warning and Risk Assessment

HPAI infection still is being found wild birds and domestic poultry populations of countries in Asia. There is a risk of spill over of HPAI infection in countries of this region due to the active circulation of virus in the environment and a lack of effective and well implemented compensation schemes for backyard poultry farms designed in part to promote early reporting, poor biosecurity and the role of live bird markets and reoccurrence of cases in wild birds in 2006 in Qinghai Province, China.

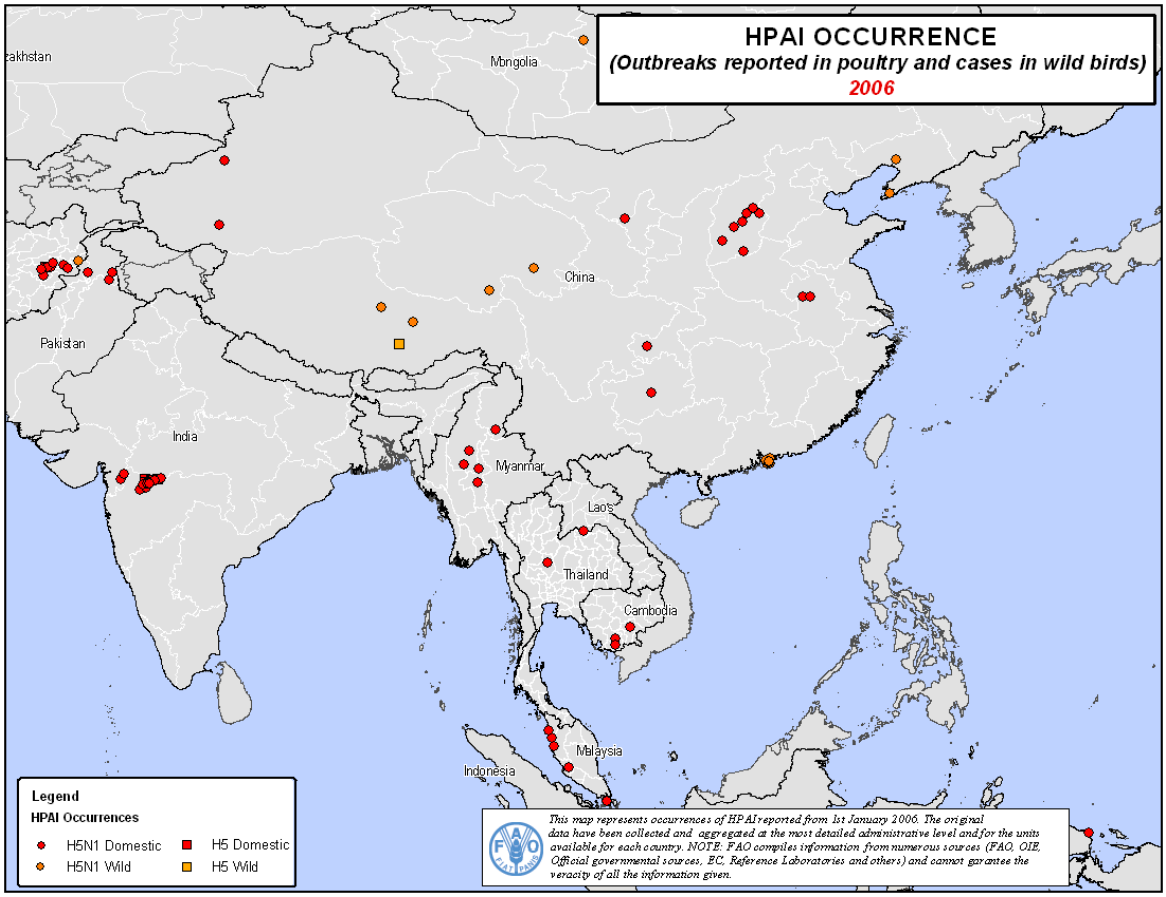
HPAI outbreaks continue to be reported in Asia in both compartments (Figure 5) and majority of outbreaks are now being reported in backyard poultry farms. The level of awareness is high in commercial poultry farms and the disease only is maintained and spread in FAO sector 3 and 4[3] of poultry production systems. Indeed, backyard poultry farms owners do not have enough information

3 FAO classification of poultry production systems includes four categories. Sector 3 correspond to commercial poultry farms with low biosecurity and sector 4, village poultry type or backyard systems.

and knowledge on HPAI which makes its identification difficult since other avian diseases, such as Newcastle disease are prevalent. Moreover, small backyard farm owners do not have resources to improve husbandry systems, biosecurity, adequate access to compensation and veterinary and para professional services. This makes this poultry sector highly vulnerable to HPAI and other avian diseases.

Tibet Provinces in China. These cases appeared at the same time that wild bird H5N1 cases were confirmed in May 2005. This is the second consecutive year with HPAI in wild birds in Qinghai Province (through east ~200 km from Quinghai Lake) and the species of wild bird affected were migratory *Anatidae* species (geese, ducks and swans), gulls and cormorants and resident species including crows and magpies. It is possible that the virus survived the winter in the

Figure 5. HPAI outbreaks in poultry and wild birds in Asia in 2006



Two main factors are involved in the maintenance and spread of HPAI infection in Asia. The circulation of HPAI virus within domestic poultry especially in FAO poultry sectors 3 and 4, and secondly migratory wild birds which have played and could likely continue to play a role in introducing HPAI H5N1 virus over long distances to densely poultry areas, although more information is needed to validate this working hypothesis.

In May and June 2006, new cases of HPAI in wild birds were confirmed in Qinghai and frozen waters of this lake and have reinfected birds that had arrived to nest. It has been demonstrated that wild birds species especially waterfowl present the highest prevalence and diversity of influenza A viruses. The breeding season in northern regions of Eurasia is brief and birds start their southern migration during July/August. The scientific evidence indicates that wild birds can be infected by HPAI virus but still there is very limited information on the persistence of the virus in species of particular concern. However, wild bird infection alone is not the

unique factor explaining the geographical distribution of HPAI outbreaks and information on precise time of migration is essential to understand the role of different species of wild birds in the epidemiology of HPAI.

Human, production and trade factors are mainly responsible in the spread of HPAI in Asia. The explosive growth of poultry production in Asia during the last decade has facilitated the persistence of HPAI virus circulation. On the other hand, compensation schemes were introduced in Cambodia, China, Thailand and Vietnam in 2005 in order to help farmer recover losses from culling of birds and to improve early reporting especially from backyard poultry farms. Differences observed in compensation rates applied by countries in Asia could increase the risk of illegal trade of infected poultry between neighbouring zones or even between countries.

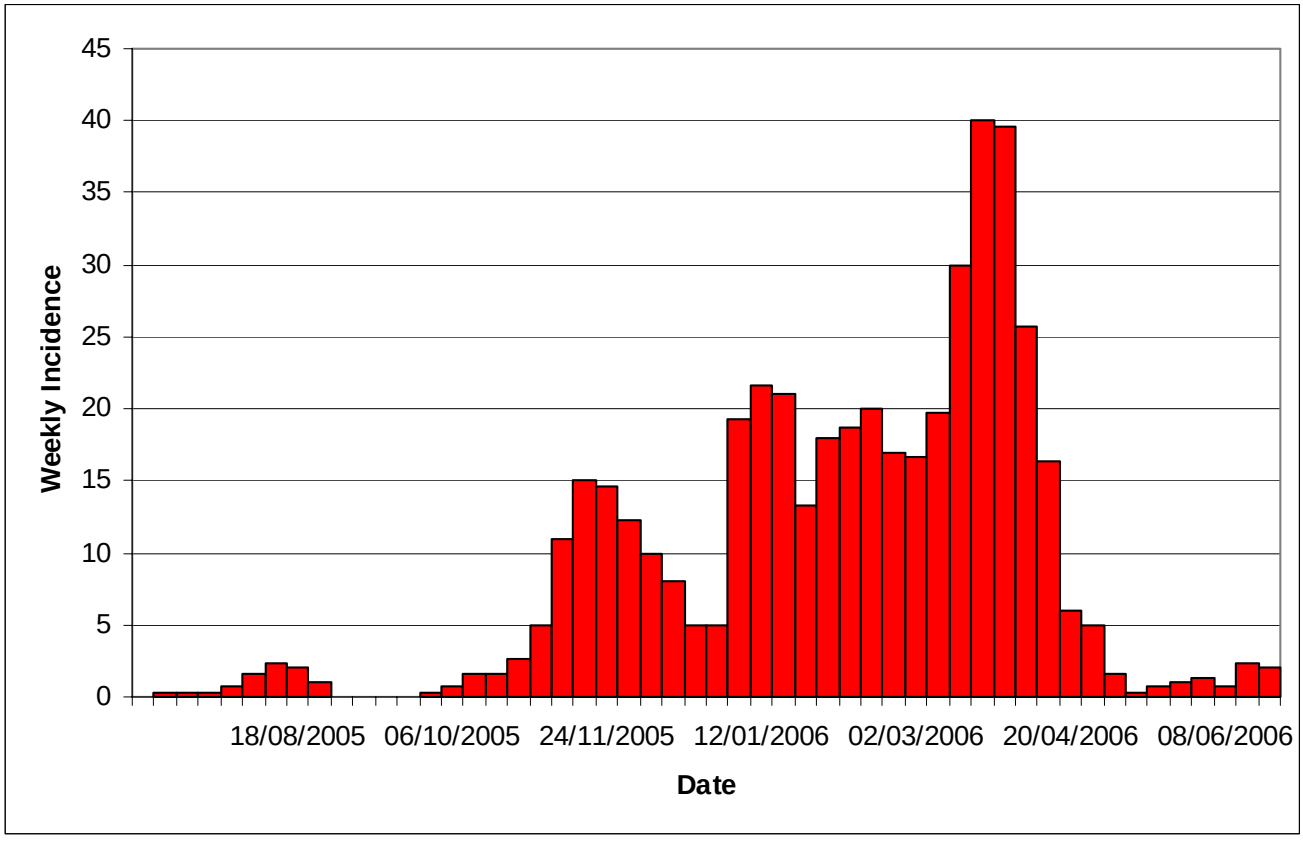
1. Some facts that describe the ongoing situation and the evolution of HPAI in Asia are:

2. The occurrence of new HPAI outbreaks in newly affected countries such as Afghanistan, India and Pakistan indicates a new geographical expansion of HPAI within Asia.

3. There is a reduction of HPAI outbreaks officially reported and more specifically reports of outbreaks in commercial and intensive poultry producers in 2006 compared with the period 2004-2005. This could indicates that the level of virus circulating has diminished in commercial poultry farms as a consequence of effective control measures including massive vaccination of birds in Vietnam, Indonesia and China and increased biosecurity in poultry or targeted farms and live bird markets. Outbreaks of HPAI will continue to occur sporadically in Asia mainly from backyard poultry farms therefore a better understanding of the epidemiology of HPAI in this compartment is still needed to refine control strategies in this region.

4. The confirmation again of a high number of cases in wild birds in Qinghai Province between April and May 2006 which

Figure 6. HPAI outbreaks in Asia since June 2005 (poultry and wild birds)



occurred at the same time those detected in 2005 reflect that HPAI virus is still circulating in the habitat of the wild birds or the environment in this area, non-migratory species harbour the disease, do not die from it, and intermittently shed virus, nearby poultry farms serve as the over wintering location of the virus, or migratory birds carry the disease as they migrate. Bar-headed geese presented the high proportion of cases but other species of wild migratory and resident birds affected could play a role acting as bridge species of infection between migratory wild birds and terrestrial fowl.

5. The reoccurrence of HPAI in poultry farms in 2006 in China, Indonesia, Malaysia, Myanmar and Thailand indicates that the virus still is persisting in those countries

6. Indonesia remains the major concern in Asia due to the uncertainty of the magnitude of the HPAI outbreaks. Human cases were confirmed in April-May 2006 and no official animal disease reports were communicated in the same area. The incidence of HPAI H5N1 in Indonesia is high in poultry farms and households, but official reporting requirements remain forthcoming.

7. Backyard poultry farms in Asia account for almost 70% of the poultry population in Asia and most of the outbreaks in 2006 were reported in this sector. Backyard poultry farms are vulnerable to HPAI and with poor compensation schemes; access to veterinary services, and limited public awareness campaigns, the true occurrence of HPAI is not registered in this sector.

8. There is a need to assess the risks of HPAI due to legal and illegal wildlife trade in Asia. This factor was poorly characterised and wildlife trade could play a role in the maintenance, introduction and spread of HPAI into unaffected areas.

9. There is a need to conduct more extensive wildlife surveillance focusing on, both resident and migratory species, particularly in areas of poultry production and important aggregation sites.

6. Conclusions

Delayed transferring of information and incomplete disease reporting may have lead to an endemic situation, especially in backyard poultry farms. Implementation of compensation schemes especially orientated to backyard poultry farms will likely to improve the quality and reliability of disease reporting and help to reduce the risk of H5N1 virus spread in live bird markets, backyard poultry farms and potential human cases linked to HPAI outbreaks in poultry. Innovative approaches to utilise local animal health technical services (i.e. veterinary paraprofessionals) and *Participatory Disease Surveillance* (PDS) would strengthen the National veterinary service surveillance system.

New sporadic outbreaks of HPAI could occur in zones located near endemic areas and zones where illegal or informal (traditional) movement of birds and products still occur. Outbreaks of HPAI that occur in areas where vaccination programs were implemented, should be investigated carefully to evaluate whether appropriate biosecurity practices were followed along with vaccination protocols recommended by FAO and OIE and the vaccine manufactures.

An increase in wild bird surveillance for HPAI should include sampling migratory and resident wild birds to clarify the role of these species in the epidemiology of HPAI (including dead wild bird submissions). Disease surveillance in domestic poultry, live bird markets and understanding pathways of illegal movements of birds and fighting cocks are all important factors that will help elucidate the role that these sectors play in the spread or maintenance of the disease.

7. References

BirdLife International. Wild Bird H5N1. http://www.birdlife.org/action/science/species/avian_flu/pdfs/h5n1_outbreaks.pdf

Gilbert M., Wint W., Slingenbergh J. 2004. The ecology of Highly Pathogenic Avian Influenza in East and Southeast Asia: outbreaks distribution, risk factors and policy implications.FAO Report, August 2004.

Gilbert M., Xiangming X; Wint W.; **Slingenbergh J. 2006.** Poultry production dynamics, bird migration cycles, and the emergence of highly pathogenic avian influenza in East and South East Asia. FAO/OIE International Scientific Conference on Avian Influenza and Wild Birds Rome, May 30-31, 2006.

Rushton, J, Viscarra, R, Guerne Bleich E and McLeod, A. 2004. Impact of avian influenza outbreaks in the poultry sectors of five South East Asian countries (Cambodia, Indonesia, Lao PDR, Thailand, Vietnam) outbreak costs, responses and potential long term control. FAO report TCP/RAS/3010 Emergency Regional Support for post avian influenza rehabilitation.

Dolberg, F.; GuerneBleich, E and Mc.Leod A. FAO 2005. Summary of project results and outcomes of TCP/RAS/3010 Emergency Regional Support for Post-Avian Influenza Rehabilitation.

World Organisation for Animal Health (OIE). Update on avian influenza http://www.oie.int/downld/AVIAN%20INFLUENZA/A_AI-Asia.htm