

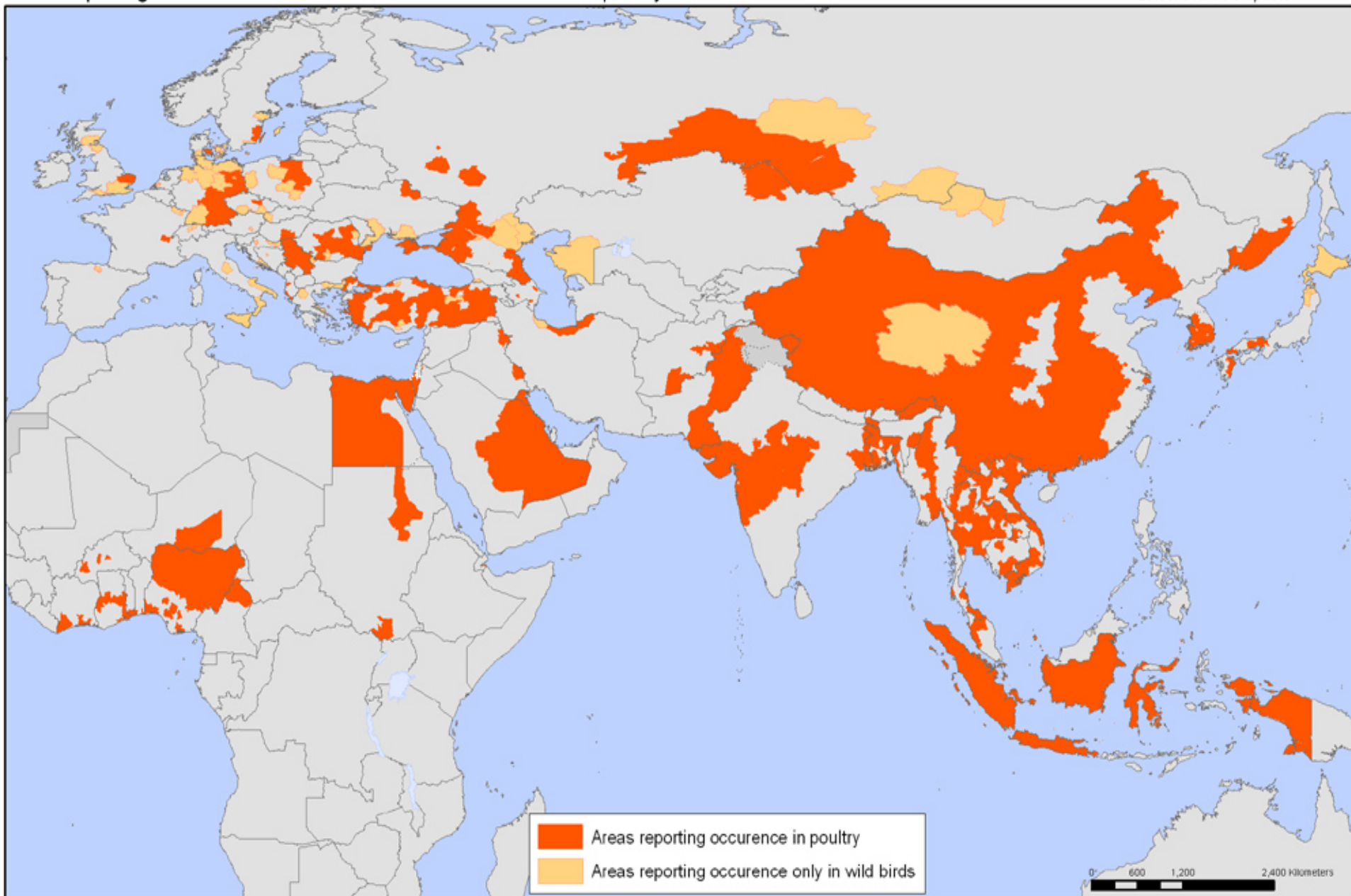


What is the role of wild birds in HPAI emergence and spread?

What data is needed to address their role in the ecology of this disease?

**Scott Newman
EMPRES Wildlife Unit - ECTAD
Animal Health Service
Animal Production & Health
Food & Agriculture
Organization, Rome Italy**

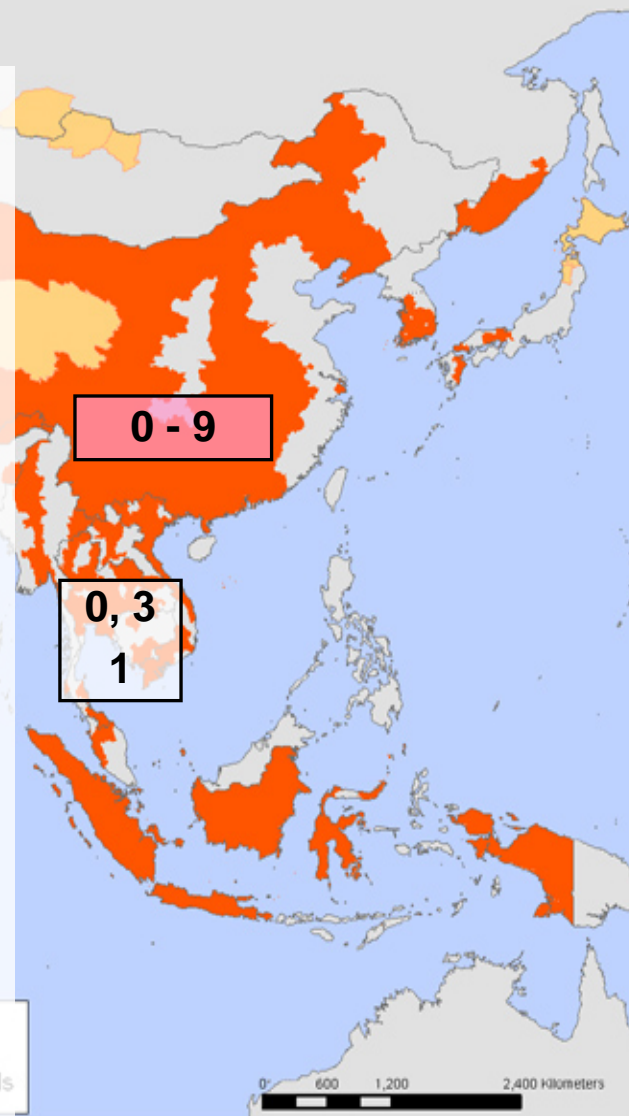


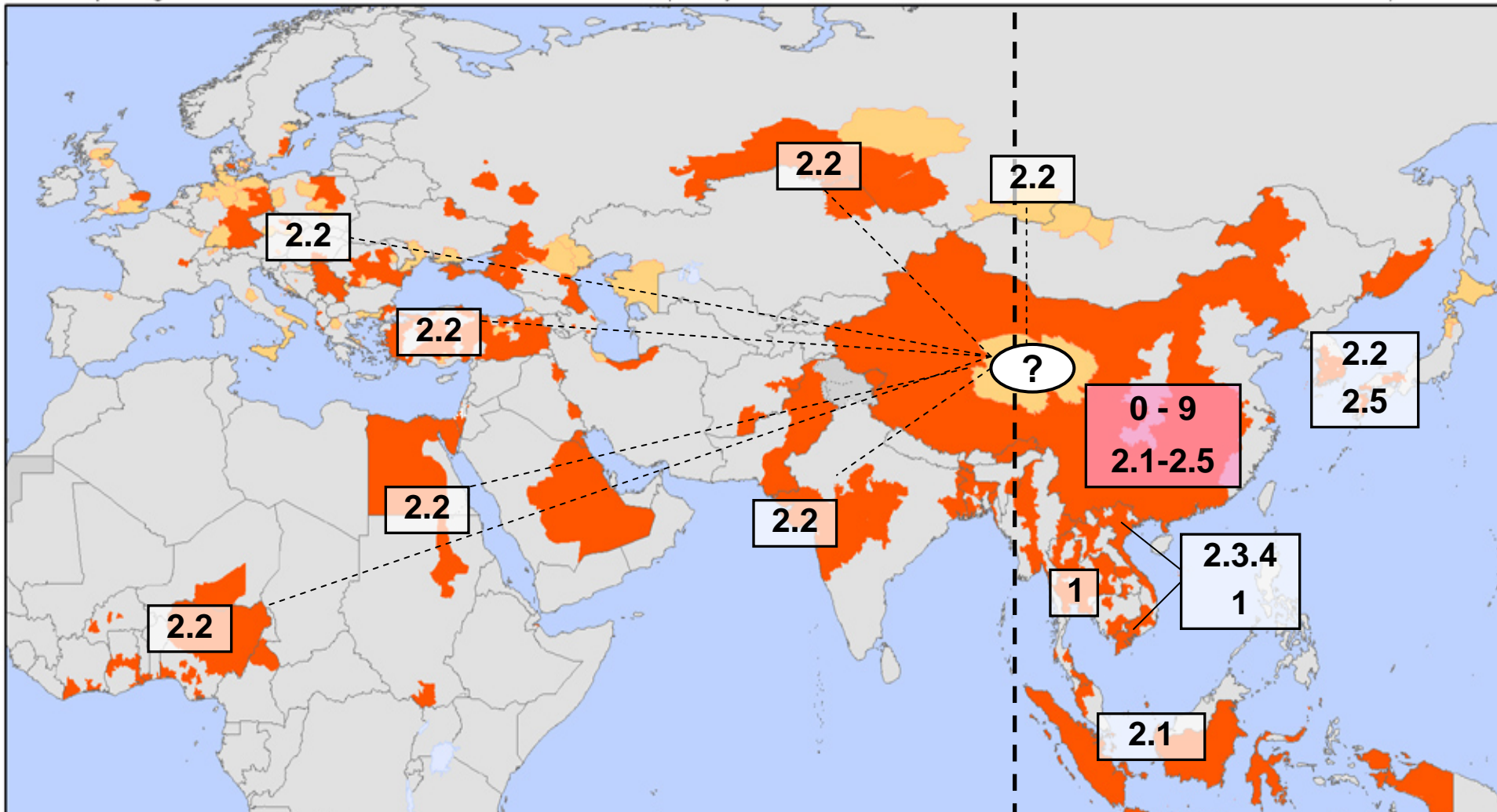


Evolution of HA genes of H5N1 HPAI viruses

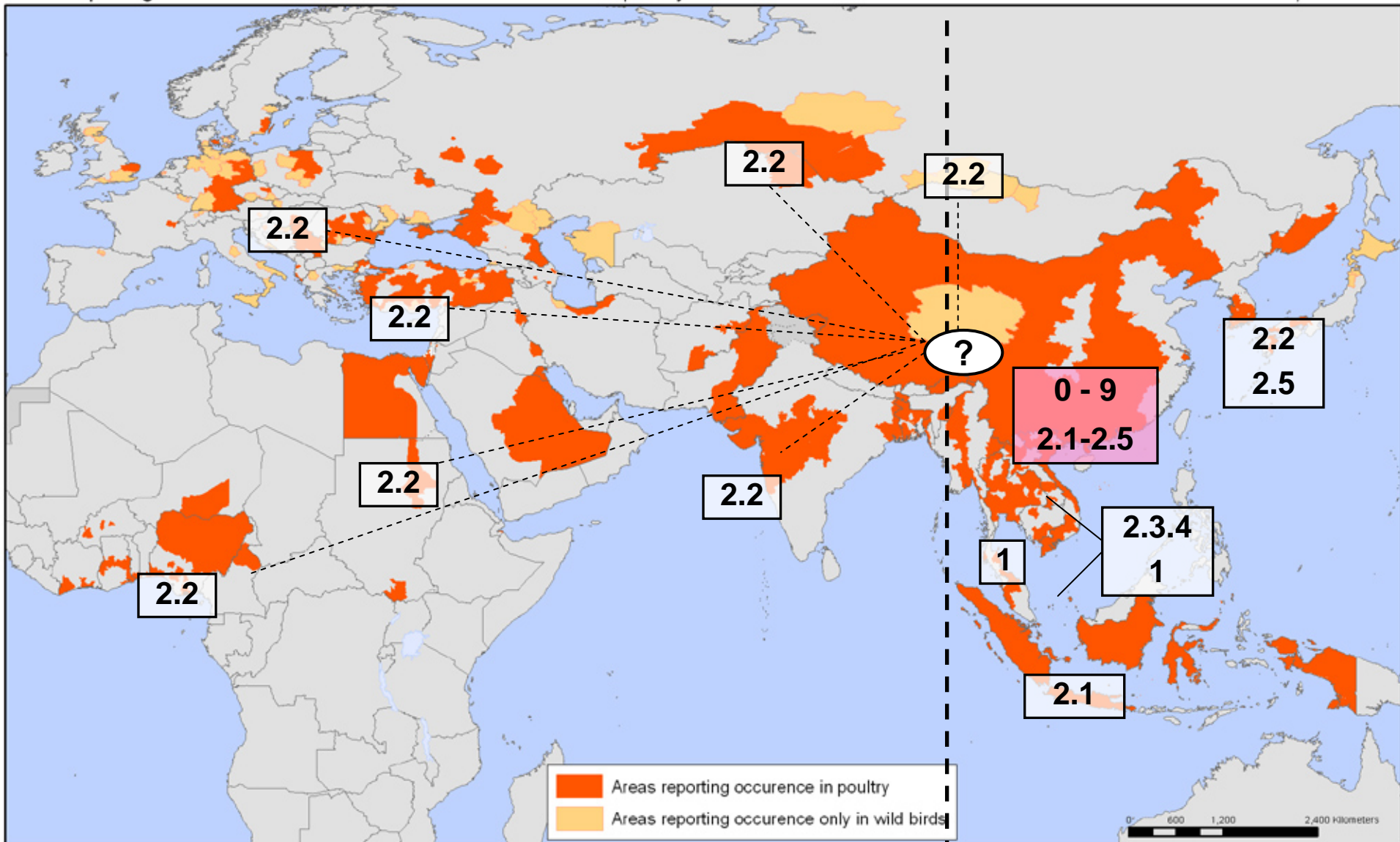
- Ancestor: A/goose/Guangdong/1/96 - southern China
- Gs/GD/1/96 HA gene has evolved extensively in the past decade, diverging into clades 0-9
- China is the only country that has all 10 HA clades
- In Southeast Asia from 1996-2002 viruses with clades 0 & 3 HA genes were predominant in poultry
- In Southeast Asia from 2002-2005, viruses with clade 1 HA genes were predominant in poultry
- Evolution Working Group unified system for HA clade designation of H5N1 viral strains (WHO, OIE, FAO

2008)

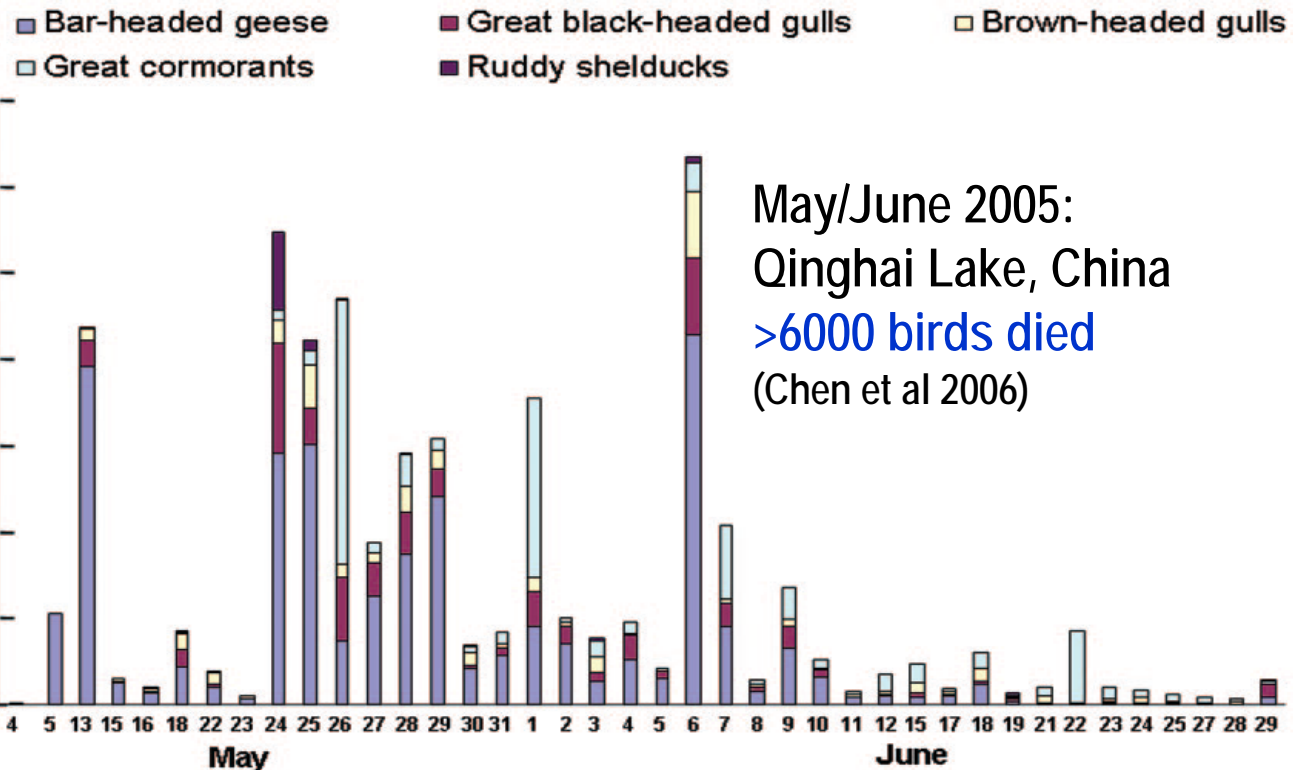




- In 2005, HA Clade 2.2 viruses (Qinghai-like lineage) spread westward to more than 30 countries in Europe, the Middle East and Africa (Salzberg et al. 2007)
- In 2005, emergence of a new divergent HA Clade 2.3.4 (Fujian-like lineage) in southern China, began to spread in SE Asia region (Smith et al. 2006)

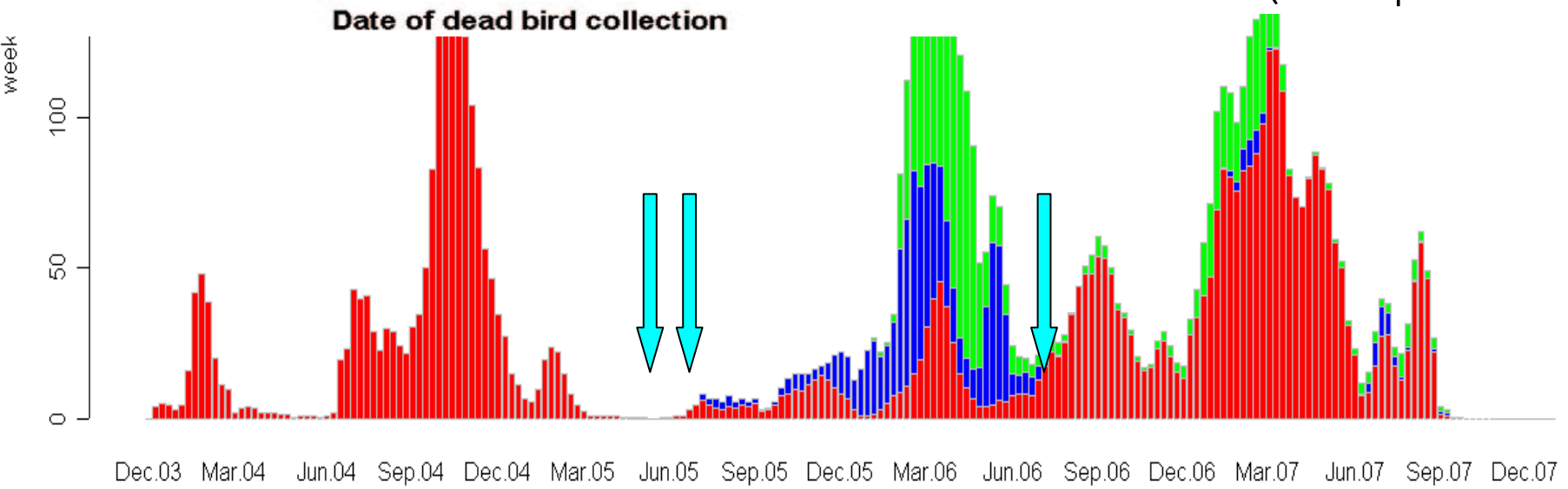


Most viruses isolated in wild Anatids since 2005 belonged to the Qinghai-like lineage of HPAI H5N1



July 2005:
 Lake Chany, Russia
 > 5000 wild birds
 Pochard (*Aythya ferina*)
 Mallard (*Anas platyrhynchos*)
 Teal (*Anas crecca*)

Summer 2006:
 Tuva Republic, Russia
 > 3100 wild birds
 100% Great Crested
 Grebe (*Podiceps cristatus*)



Susceptibility of Wild Anatids to HPAI H5N1

Experimental infection surveys



- ✓ **Species variation in susceptibility, clinical disease & pattern of viral shedding**
- ✓ **Variation also associated with age, immunologic status, virus strains & concentration of infectious dose**
- ✓ **Almost all inoculated birds were successfully infected and excreted virus**
- ✓ **Birds consistently excreted higher viral titers & for longer durations from the pharyngeal vs cloaca**

Susceptibility of wild Anatids to HPAI H5N1

Experimental infection surveys



- ✓ viral shedding generally first detected at 1 day post-innoculation, on average for 4 days (1-8d)
- ✓ almost all infected birds showed a period of asymptomatic viral shedding
 - birds excreting virus without any clinical sign (asymptomatic birds)
 - birds excreting virus for several days before the onset of illness
- ✓ duration potential asymptomatic spreading: 4 days (1-8d)

Event 1 suggesting wild birds play a role in the spread of H5N1 HPAI







1 bar-headed goose

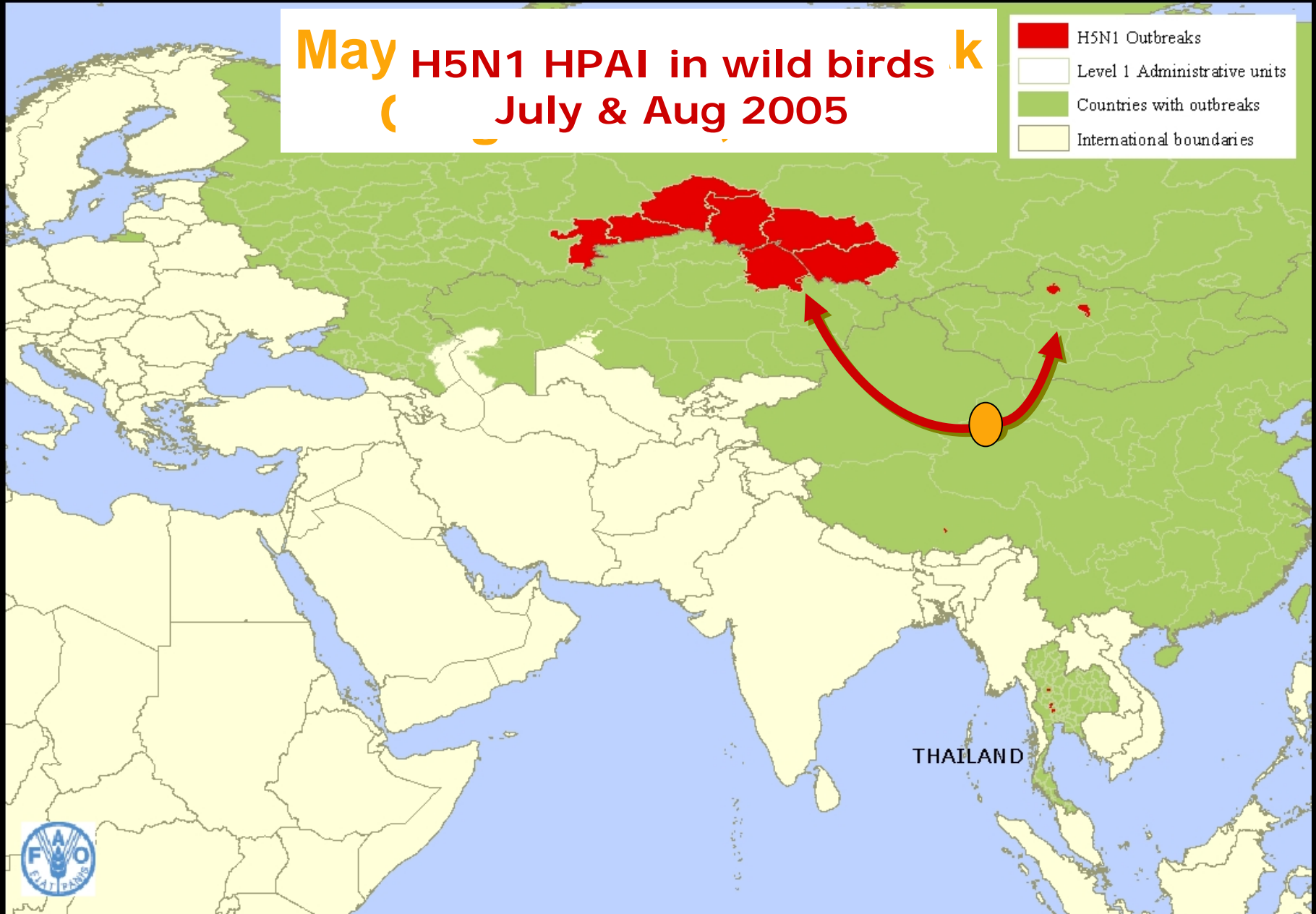


4 whooper swan



May H5N1 HPAI in wild birds July & Aug 2005

-  H5N1 Outbreaks
-  Level 1 Administrative units
-  Countries with outbreaks
-  International boundaries



Satellite-marked waterfowl reveal migratory connection between H5N1 outbreak areas in China and Mongolia

DIANN J. PROSSER,^{1*} JOHN Y. TAKEKAWA,² SCOTT H. NEWMAN,³ BAOPING YAN,⁴ DAVID C. DOUGLAS,⁵ YUANSHEG HOU,⁶ ZHI XING,⁶ DEHAI ZHANG,⁶ TIANXIAN LI,^{7*} YONGDONG LI,⁷ DELONG ZHAO,⁸ WILLIAM M. PERRY² & ERIC C. PALM²

¹United States Geological Survey, Patuxent Wildlife Research Center, Beltsville, MD 20705 USA and University of Maryland, College Park, MD 20742 USA

²United States Geological Survey, Western Ecological Research Center, Vallejo, CA 94592 USA

³EMPRES Wildlife Unit, Animal Health Service, Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, Italy 00153

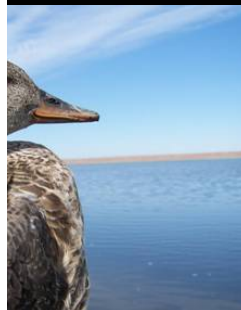
⁴Chinese Academy of Sciences, Computer Network Information Center, Beijing, China 100080

⁵United States Geological Survey, Alaska Science Center, Juneau, AK 99801 USA

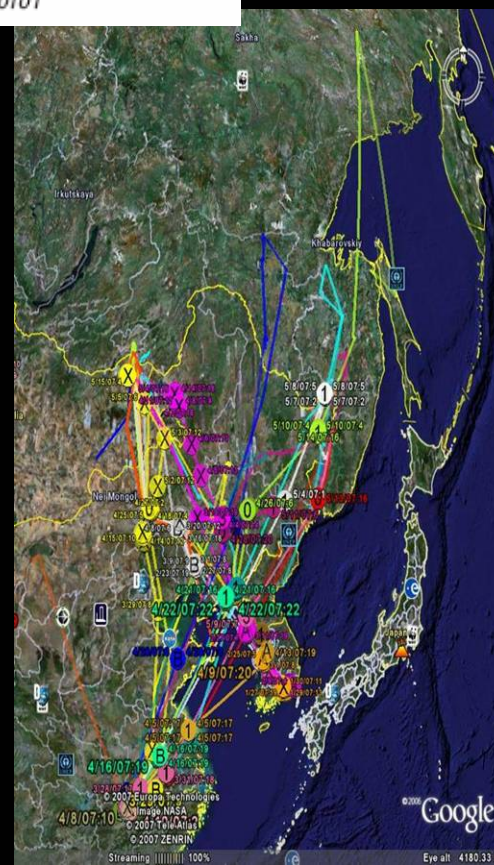
⁶Qinghai Lake National Nature Reserve, Xining, China 810003

⁷Chinese Academy of Sciences, State Key Laboratory of Virology, Wuhan Institute of Virology, Hubei, China 430071

⁸Chinese Academy of Sciences, Institute of Zoology, Beijing, China 100101



- Requires analyses of temporal & spatial relationships between wild bird habitat use, movements and disease outbreaks
- We are working in all migratory flyways where HPAI is present



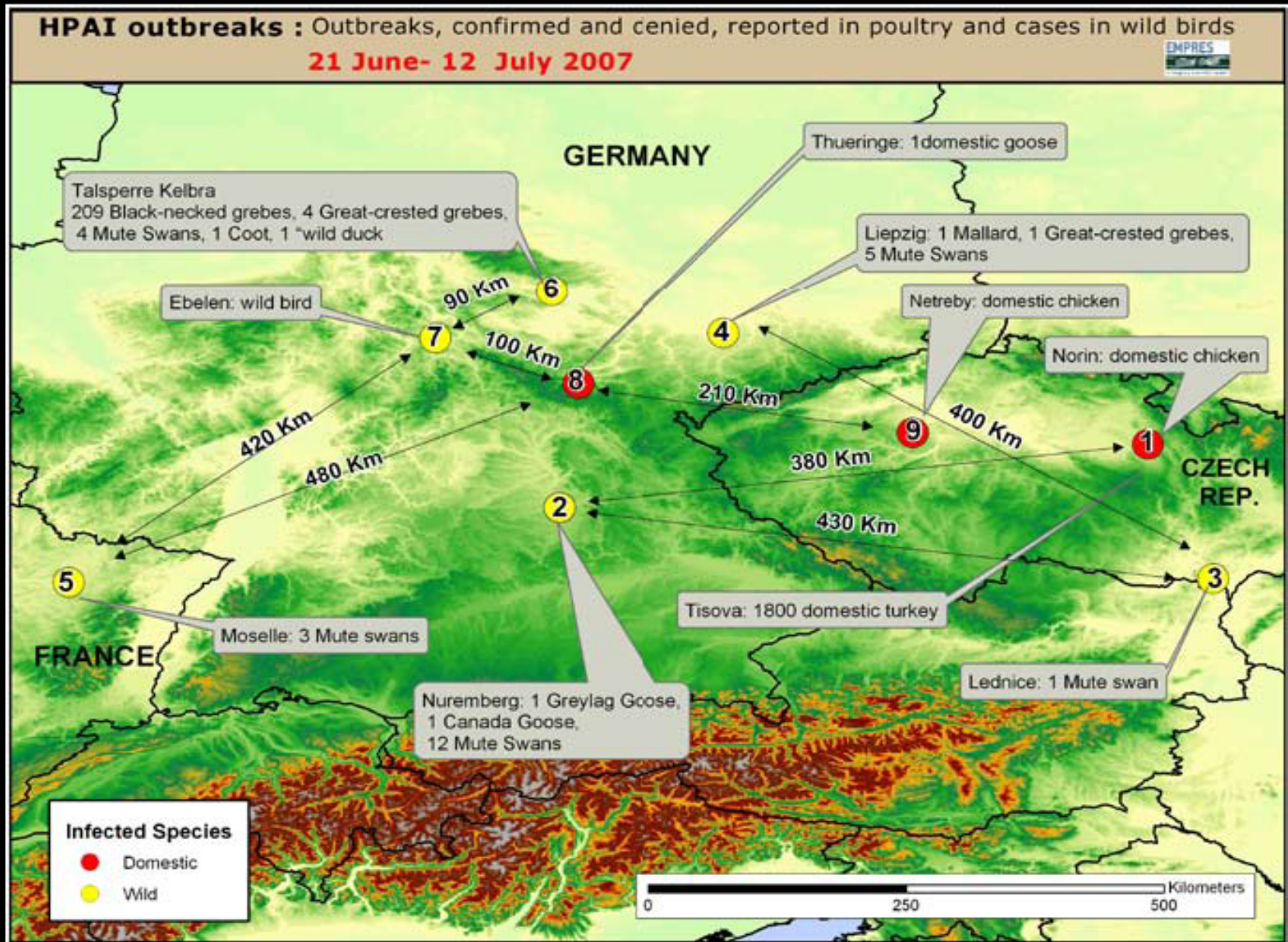
Event 2 suggesting that wild birds play a role in the spread of H5N1 HPAI

Spreading of H5N1 autumn & winter 2005-06 into Europe



H5N1 detected in > 700 dead wild birds 13 countries, but only 4 countries experienced outbreak in domestic poultry

Event 3 suggesting that wild birds play a role in the spread of H5N1 HPAI



Event 4 suggesting that wild birds play a role in the spread of H5N1 HPAI

- 4/6 outbreaks were linked to wild bird introductions
- Virus came from apparently healthy hunted birds from 4 different wetlands along the Black Sea coast
- HUMAN ACTIONS mediated transmission from the wild birds to poultry - infectious materials (feathers & viscera) from cleaned hunted was fed to back-yard poultry
- One buzzard (*Buteo buteo*) found moribund & euthanized was positive for H5N1 HPAI



CRISIS MANAGEMENT CENTRE – ANIMAL HEALTH
GOVERNMENT OF TURKEY



Investigation of the role of wild birds in Highly Pathogenic Avian Influenza
Outbreaks in Turkey between January and February 2008

MISSION REPORT

19 February to 12 March 2008

Prepared by: Scott Newman, Wildlife Coordinator, EMPRES, Animal Health Service, FAO
Nick Honhold, Veterinary Epidemiologist, EMPRES, Animal Health Service, FAO

With contributions from:





Javier Sanz-Alvarez, Ornithologist, EMPRES, Animal Health Service, FAO
Kiraz Erciyas, Ornithologist, Ondokuz Mayıs University Ornithological Research Centre, Turkey
Taej Mundkur, Deputy Wildlife Coordinator for Avian Influenza, EMPRES, Animal Health Service, FAO

Date: 14 April 2008

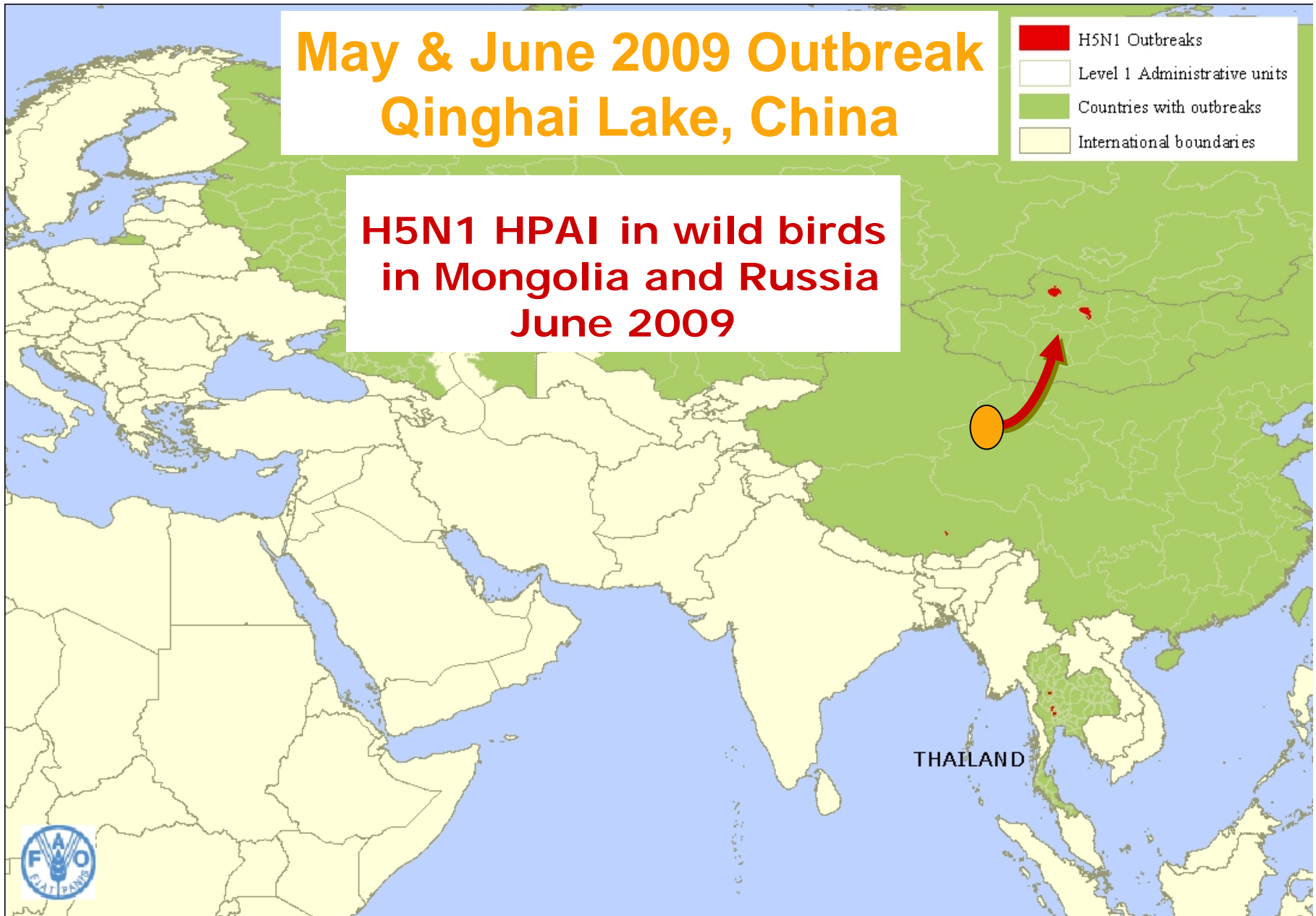
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Event 5 suggesting that wild birds play a role in the spread of H5N1 HPAI

May & June 2009 Outbreak Qinghai Lake, China

-  H5N1 Outbreaks
-  Level 1 Administrative units
-  Countries with outbreaks
-  International boundaries

**H5N1 HPAI in wild birds
in Mongolia and Russia
June 2009**



Reason 1 suggesting wild birds don't play a major role
in H5N1 HPAI spread

Circulation in wild birds?

- ✓ Active surveillance- free ranging healthy wild birds (>500,000 birds)
 - almost no infection with HPAI H5N1 detected
- ✓ The few positive HPAI H5N1 birds exhibit no apparent clinical signs
 - 6 wild ducks in China in Jan. 2005 (n> 4600, Chen et al. 2006) ?
 - 1 grebe (+ 2 wild ducks) in Siberia in July 2005 (Lvov et al. 2006) ?
 - 1 wild duck in Egypt in Oct. 2005 (n> 1300, Saad et al. 2007) ?
 - 2 wild ducks in China (n=12): HP in chicken, ducks geese (Li et al. 2008) ?
 - a group of Mute swans in PL and a Herring Gull in DK
 - 1 wild duck in Switzerland in Feb. 2008 (n=625, FAO, 2008)
 - Mallard & Coot from Turkey in Jan/Feb 2008 (Newman et al. 2008)

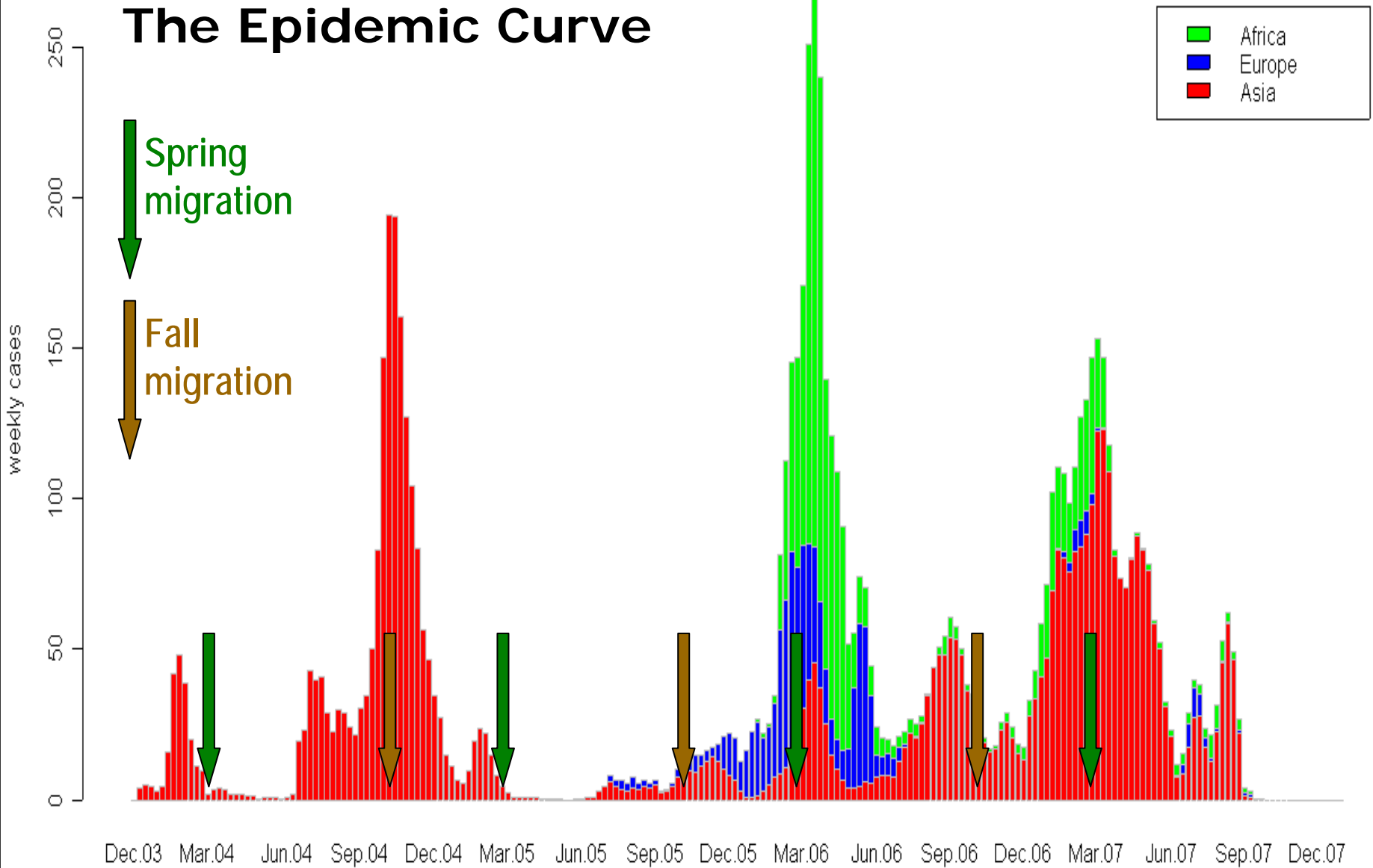
No wild bird reservoir exists for HPAI H5N1 viruses

Reason 2 suggesting wild birds do not play a major role
in the spread of H5N1 HPAI



**Timing of poultry & wild bird outbreaks related to
the timing of wild bird migration does not match up**

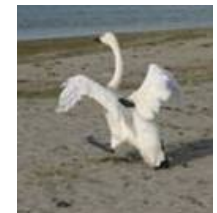
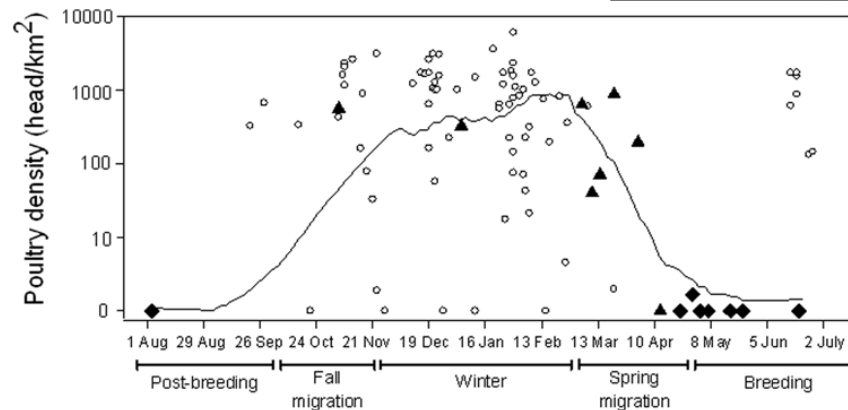
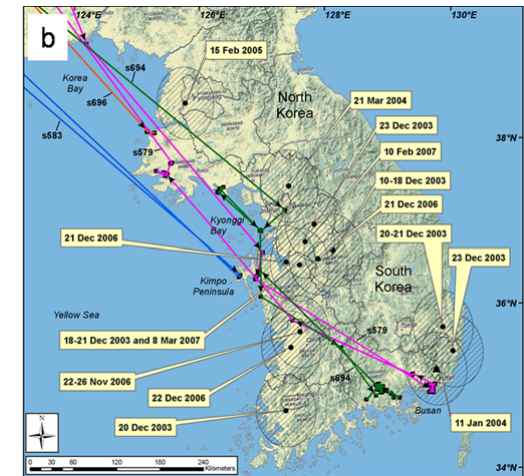
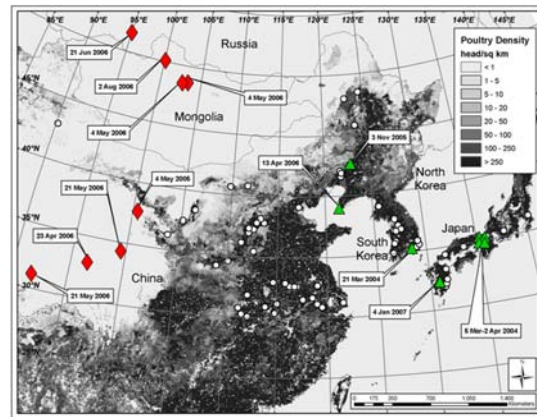
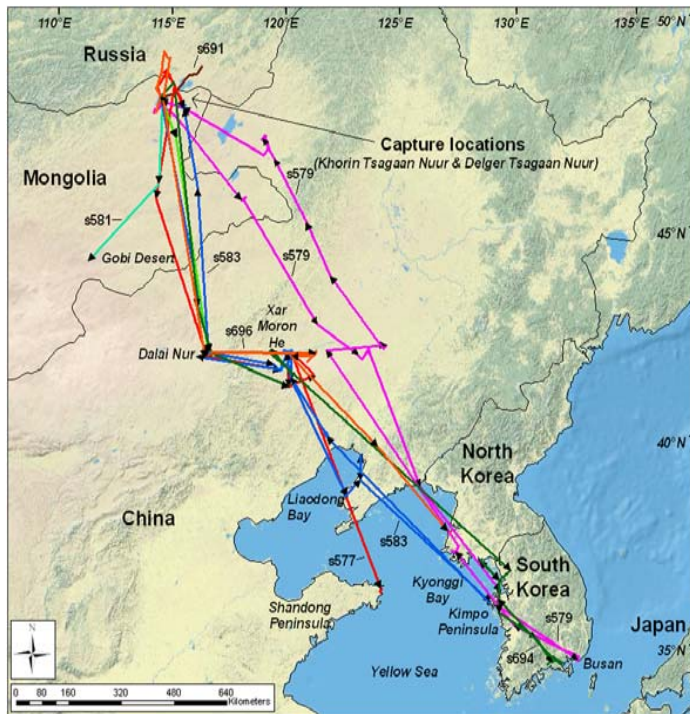
The Epidemic Curve

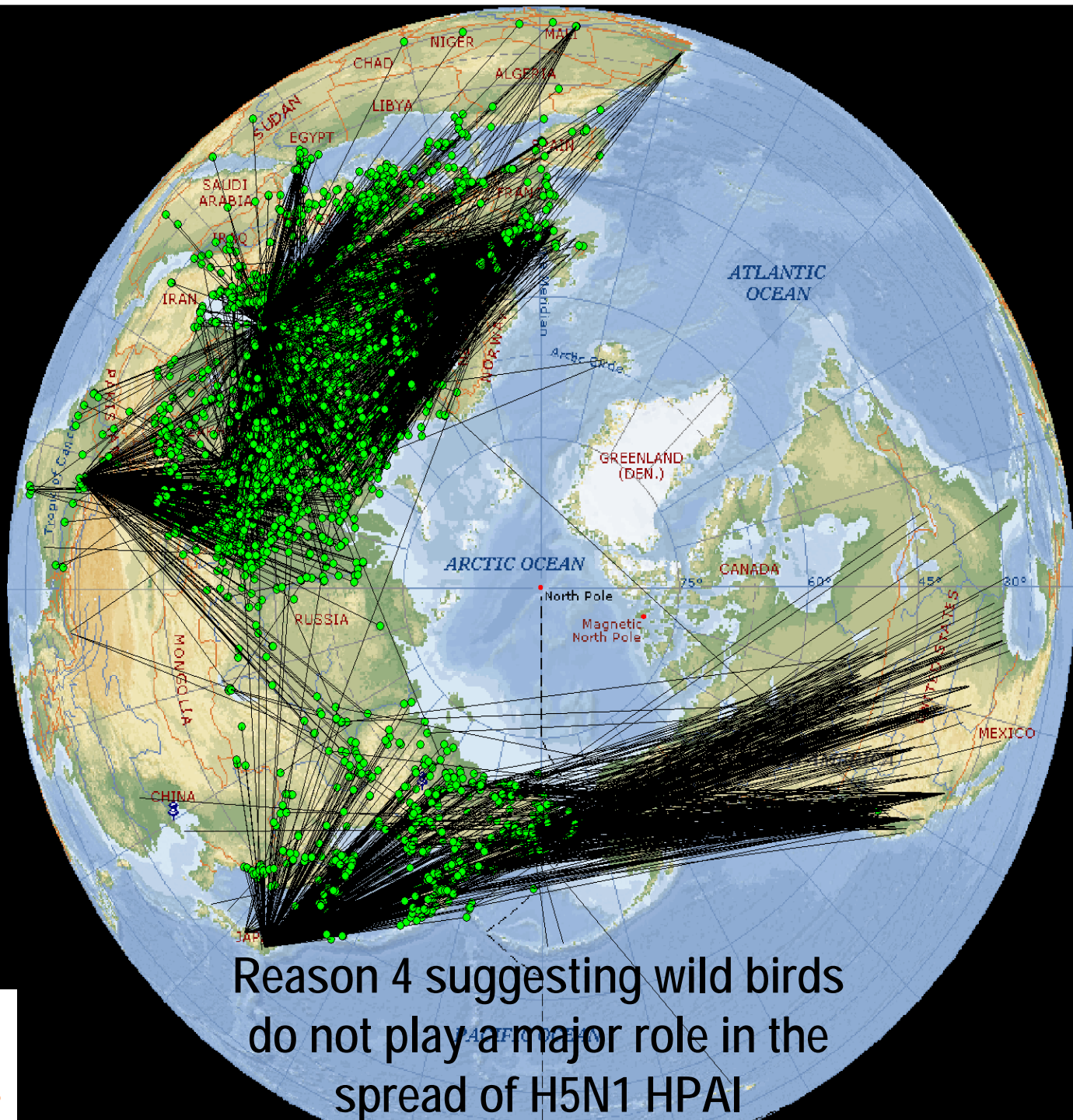
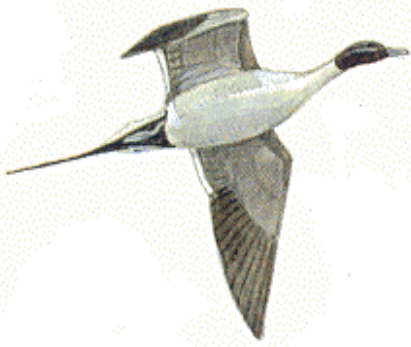


Migration of Whooper Swans and Outbreaks of Highly Pathogenic Avian Influenza H5N1 Virus in Eastern Asia

Scott H. Newman^{1,2*}, Samuel A. Iverson³, John Y. Takekawa³, Martin Gilbert², Diann J. Prosser⁴, Nyambyar Batbayar⁵, Tsevenmyadag Natsagdorj⁶, David C. Douglas⁷

¹EMPRES Wildlife Unit, Infectious Disease Group, Emergency Centre for Transboundary Animal Diseases, Animal Production and Health Division, Food & Agriculture Organization of the United Nations, Rome, Italy, ²Wildlife Conservation Society, Field Veterinary Program, Bronx, New York, United States of America, ³United States Geological Survey, Western Ecological Research Center, Vallejo, California, United States of America, ⁴United States Geological Survey, Patuxent Wildlife Research Center, Beltsville, Maryland, United States of America, ⁵Wildlife Science Conservation Center of Mongolia, and Ornithological Laboratory, Institute of Biology, Mongolia Academy of Sciences, Ulaanbaatar, Mongolia, ⁶Ornithological Laboratory, Institute of Biology, Mongolia Academy of Sciences, Ulaanbaatar, Mongolia, ⁷United States Geological Survey, Alaska Science Centre, Juneau, Alaska, United States of America





Sergei Kharitonov,
Konstantin Litvin,
Nikolay Konyukhov

Bird Ringing Centre
of Russia, IEE RAS

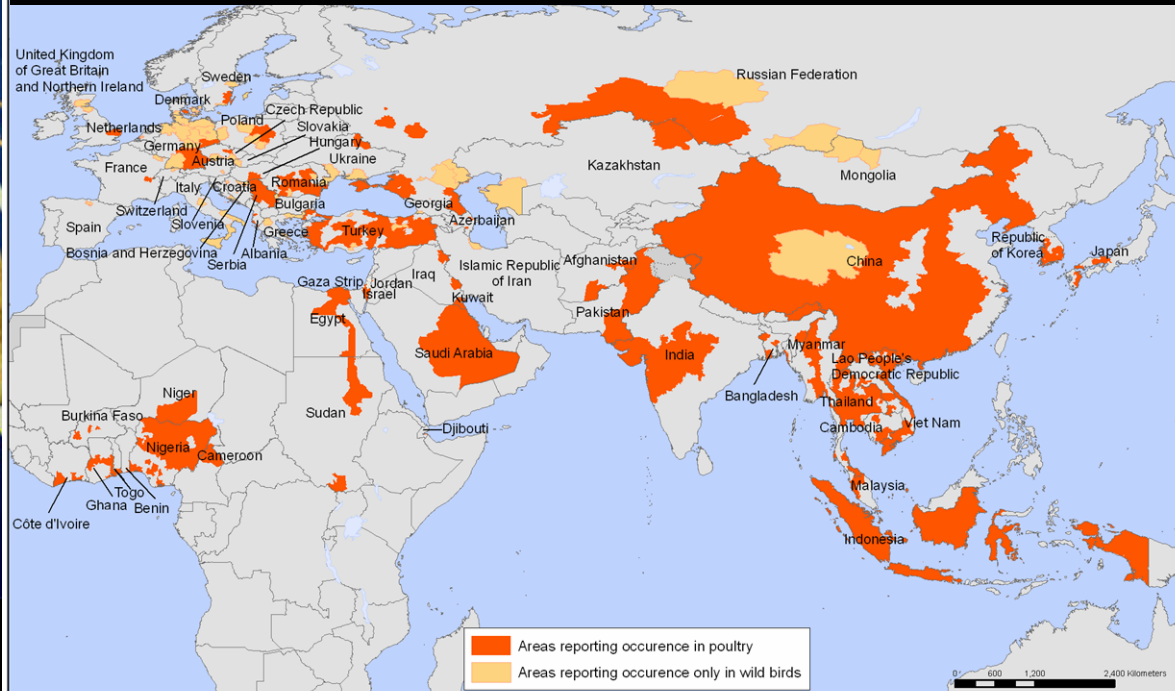
Pintail
Metapopulations

Reason 4 suggesting wild birds
do not play a major role in the
spread of H5N1 HPAI

If wild birds are the primary mechanism by which H5N1 HPAI virus is transported, why has it not spread everywhere globally by now ?



Australasian Flyway



What Data Is Needed to Assess Their Role?

That's really what the focus of this workshop is about but may include:

- ◆ Surveillance results from wild birds, especially negative results & sample sizes
- ◆ Detailed information about outbreaks (GPS locations, species, numbers, etc.)
- ◆ Wild bird ecology information: population counts, distribution, habitat use, migratory routes, over-wintering sites, breeding areas, etc.
- ◆ Location of wild and domestic bird interactions & when possible, details about timing, duration of interactions
- ◆ Live bird markets (how many, which species, volume traded) & market chains where wild and domestic birds mix
- ◆ Trade of wildlife alone across borders & for cultural practices



Wild Mute swans in Abbotsbury, UK Dec/Jan 2008 (Defra 2008)

- HPAI H5N1 confirmed in 6 carcasses of wild mute swans (*Cygnus olor*) from the Abbotsbury Swannery, Fleet Reserve, Dorset
- Viruses isolated most closely related to a cluster of isolates from domestic & wild birds from Czech Republic, Romania & Poland mid/late 2007
- Likely introduction from wild birds
- ~ 750 mute swans were counted on the Fleet in mid December 2007
- ~ 250 mute swans come to the Swannery feeding site each day
- Mallard, coot, tufted duck, & pochard (& other waterbirds) are in close contact foraging





Additional Surveillance of Health Birds at the Swannery

mute swans (n= 60)
coot (n=44) A
mallard (n =56)

WHY ?



***THANK YOU
FOR YOUR
ATTENTION***

