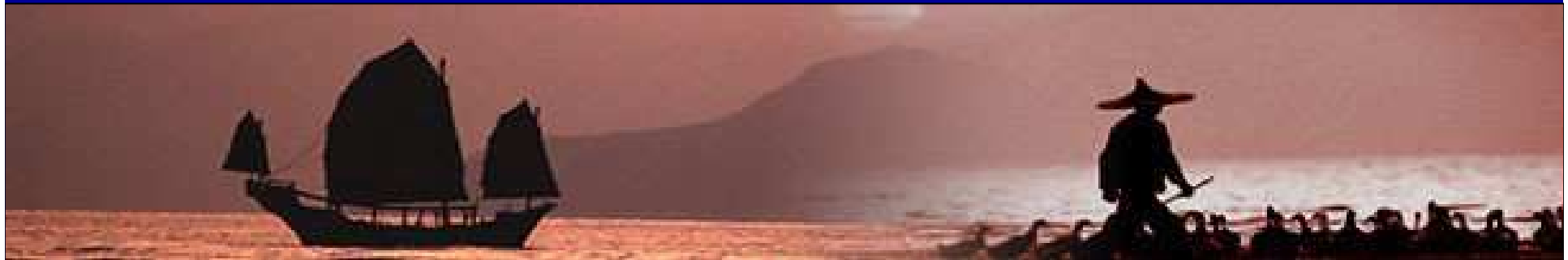


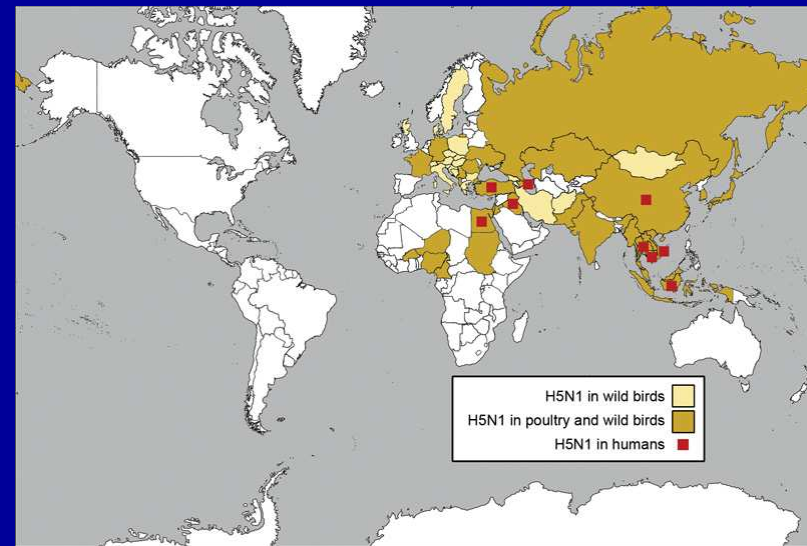
Avian influenza - current situation and future trends



Calogero Terregino
OIE, FAO and National Reference Laboratory for Newcastle Disease
and Avian Influenza, Istituto Zooprofilattico Sperimentale delle
Venezie, Viale dell'Università 10, 35020 – Legnaro, Padova, Italy

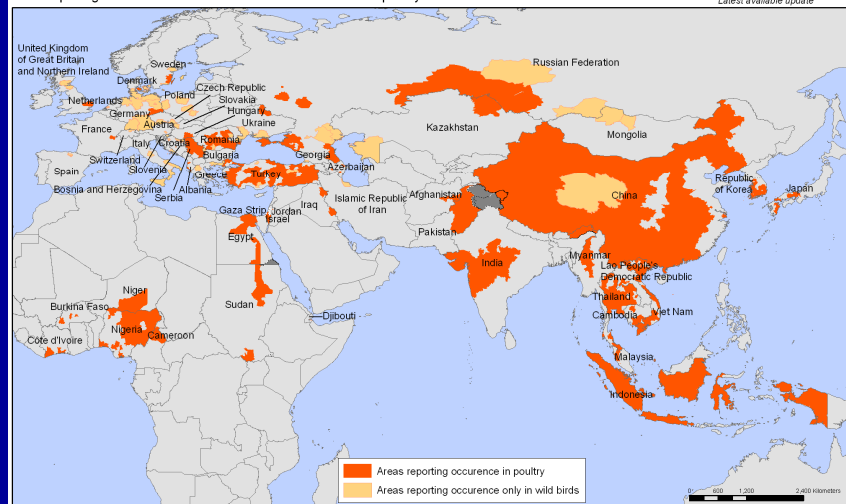
H5N1 epidemic-a disease of global relevance

- H5N1 has become endemic in poultry in several parts of the world
- It is capable of infecting a variety of birds (@50 species) and 10 species of mammals
- For every human that is infected, @ 1 million animals are infected



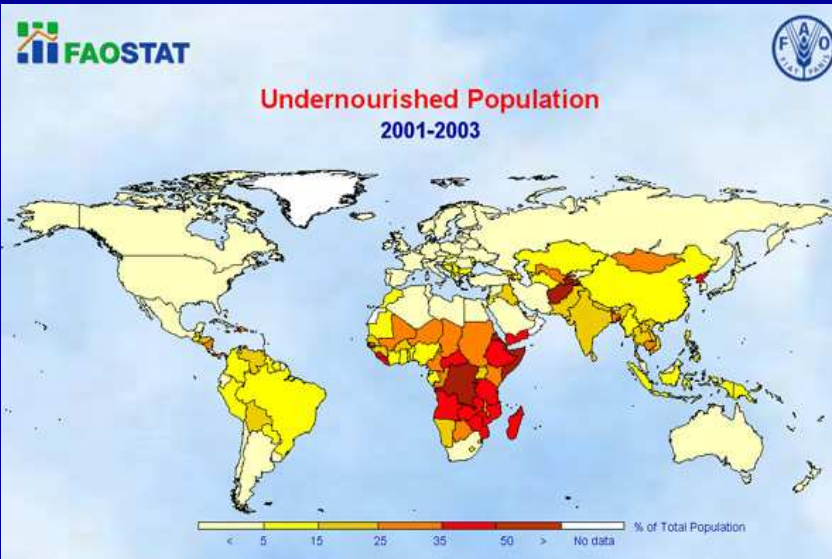
Areas reporting confirmed occurrence of H5N1 avian influenza in poultry and wild birds since 2003

Status as of 19 February 2007
Latest available update



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Data Source: World Organisation for Animal Health (OIE) and national governments
Map Production: Public Health Mapping and GIS
Communicable Diseases (CDS) World Health Organization



Challenge of the moving target

- Controlling AI is an enormous challenge for the veterinary community and local administrations
- First time in history that such a panzootic occurs, the ecology and epidemiology of AI are in constant evolution as it spreads to new ecosystems and hosts
- Significant funds and resources must be allocated and used in an organised manner – heading in the same direction
- Ongoing evaluation must feed back into adjustment strategies

“Atypical” characteristics of the H5N1 epidemic

- Involvement of waterfowl
- Spill-over to wild birds
- Billions of susceptible birds in certain affected areas
- Peculiarity of husbandry/social practices
- Infection of mammals
- Human health implications

H5N1: unprecedented eco/epidemiological situation



Involvement of other species



Wild bird reservoir



Industrial poultry



Rural poultry and mix of susceptible species



Live bird markets



Poultry reared in the open

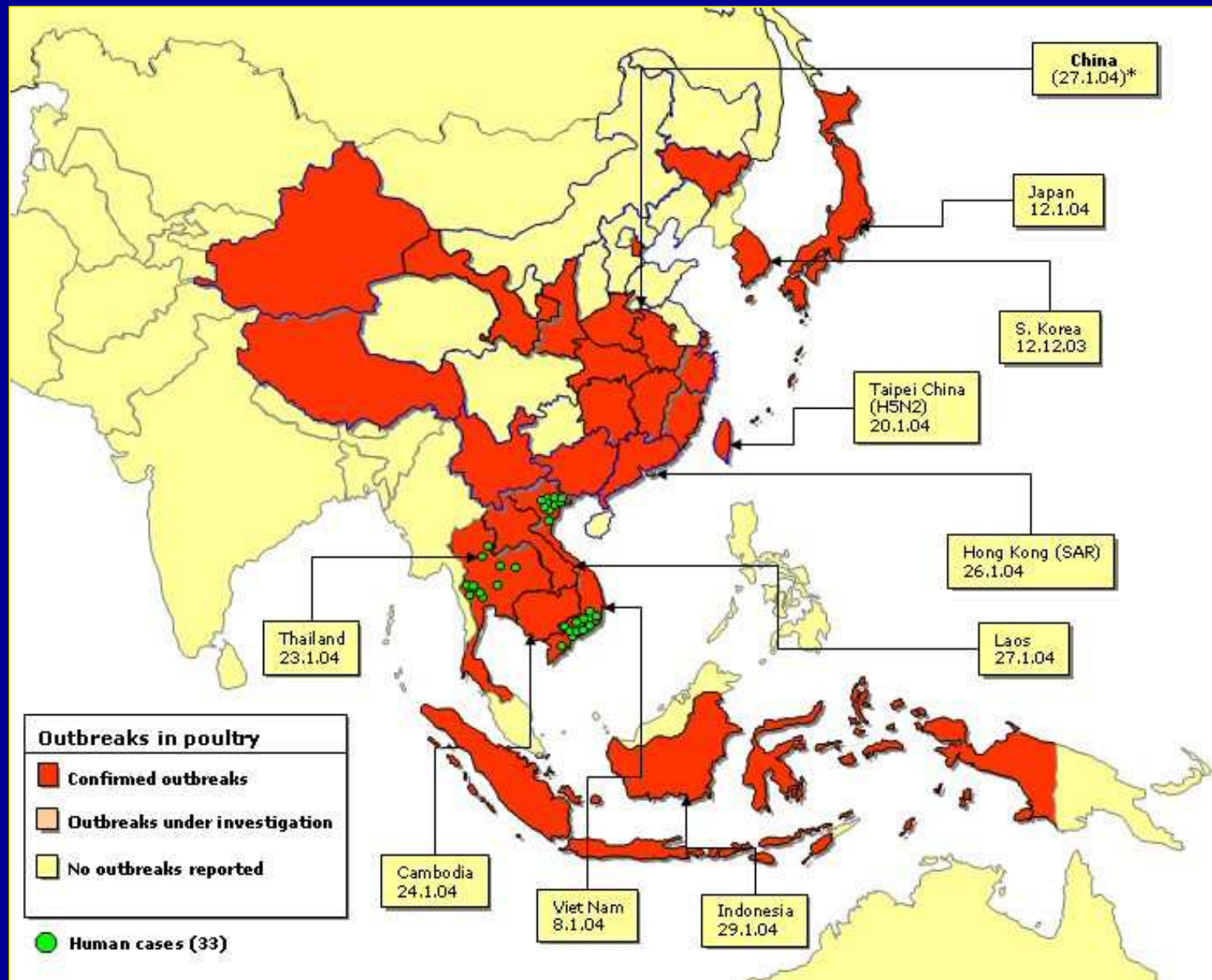
H5N1 - early reports

- 1996 progenitor HPAI virus of H5N1 subtype affected geese in Guangdong, China in 1996 (Tang et al., 1998).
- 1997 HPAI H5N1 in poultry in Hong Kong. Virus eliminated by slaughter of all poultry.
- 1999-2002 H5N1 viruses continued to be isolated in Hong Kong in retail poultry markets, waterfowl and with serious outbreaks in poultry markets and farms in 2002 (Sims et al., 2003).

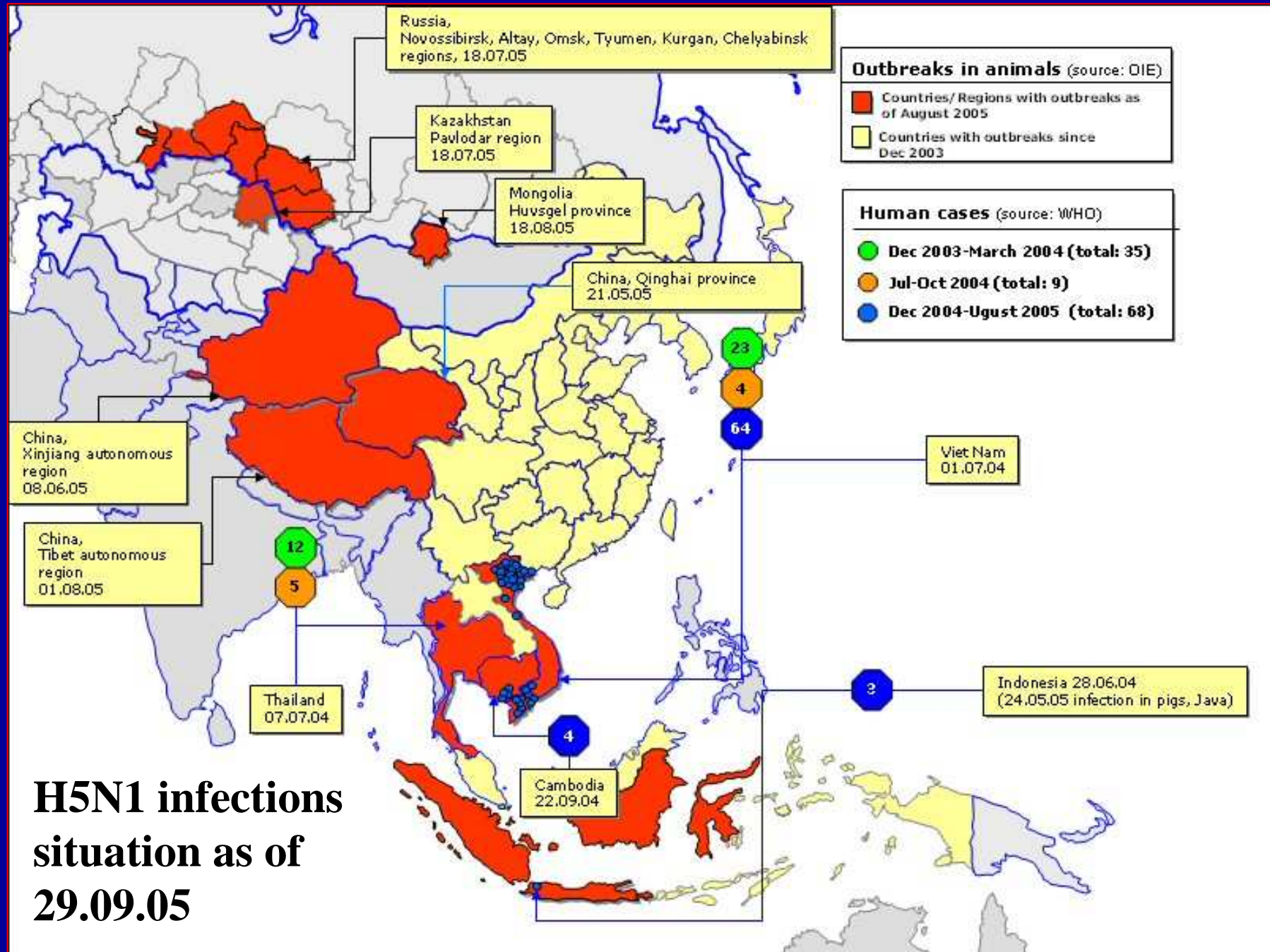
H5N1 in East Asia

- In some reports it has been considered that the HPAI H5N1 virus continued to circulate in southern China primarily in domestic ducks from 1996 [Sims et al 2005].
- This apparent low-level, but probably endemic, situation changed dramatically in December 2003 to February 2004 when suddenly eight countries in E and SE Asia reported outbreaks of HPAI due to H5N1 virus.

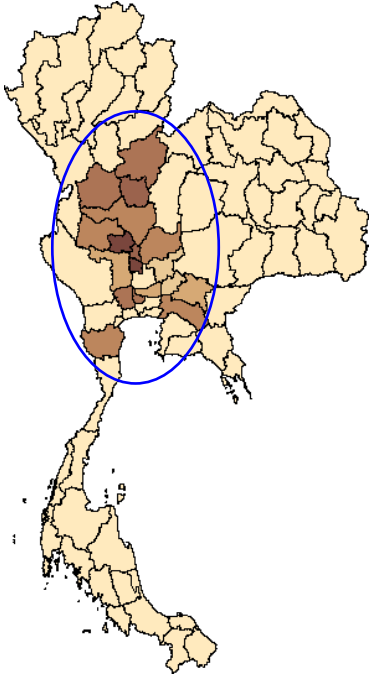
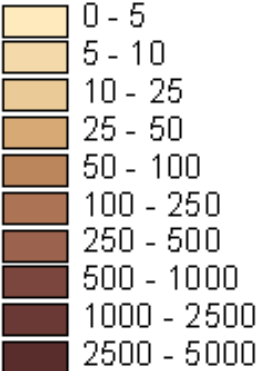
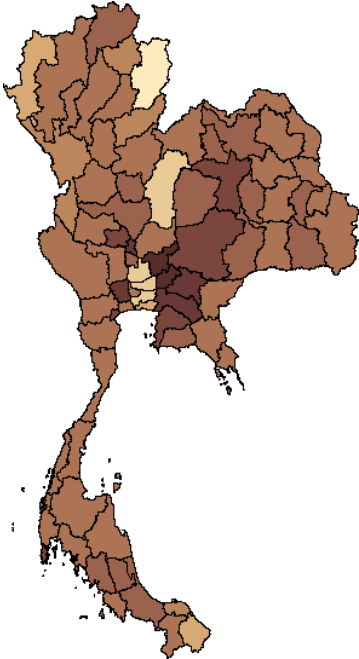
UNPRECEDENTED SPREAD IN EAST ASIA



H5N1 infections situation as of 29.09.05



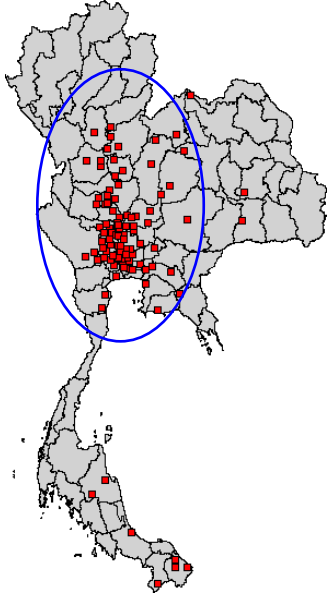
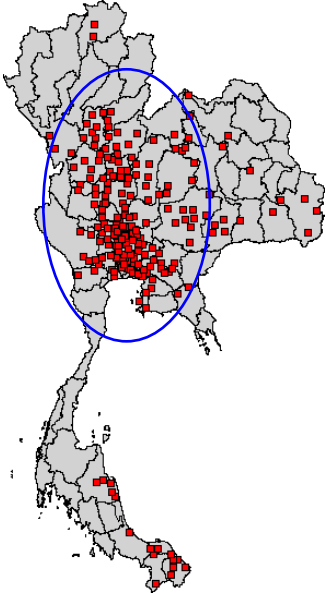
Poultry in Thailand



chickens

free range ducks

H5N1 outbreaks in Thailand



FREE RANGE DUCK REARING IN THAILAND



Dr A. Chaisingh



FREE RANGE DUCK REARING IN THAILAND

Dr A. Chaisingh

Chicken carcasses (often sick birds) placed over pond on catfish farm in Indonesia



Catfish feeding worms on chicken carcase



Ducks on the same catfish farm





Photo credit: Fabio Frisca (FAO Vietnam)



Live bird markets may play a significant role in the secondary spread of avian influenza



Live bird market in Nigeria





Chinese live bird market May 2006

Photo Trevor Drew



Chinese live bird
market May
2006

Photo Trevor Drew



Chinese live bird
market May 2006

Photo Trevor Drew



Chinese live bird
market May
2006

Photo Trevor Drew



Chinese live bird
market May
2006

Photo Trevor Drew

Poultry retailer Hong Kong





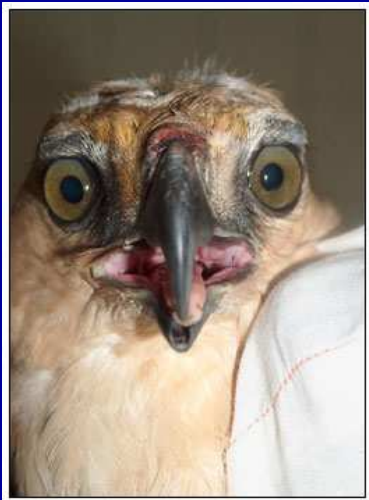


Fighting cocks have also been responsible for the spread of H5N1 virus

TWO EARLY INCURSIONS INTO EUROPE

TO BELGIUM AND GREAT BRITAIN

- Both were contained without spread
- The cause were illegal or uncontrolled trade of pet birds



Two mountain hawk eagles smuggled by a man travelling from Bangkok to Brussels in November 2004 were found to be infected with HPAI H5N1 virus genetically close to Thailand strains.

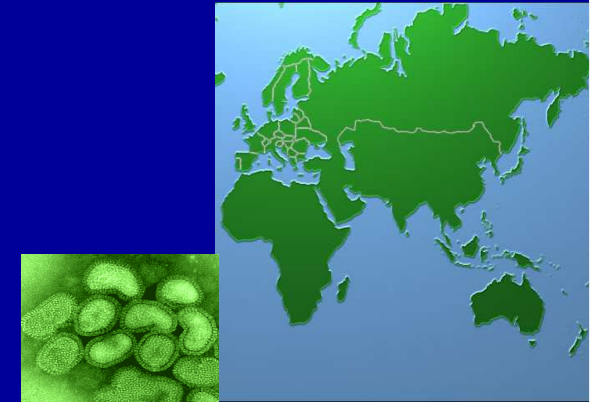
HPAI H5N1 in Europe

- Isolation of HPAI H5N1 from captive cage birds in quarantine in England
- Virus closest genetically to a 2005 Chinese duck isolate

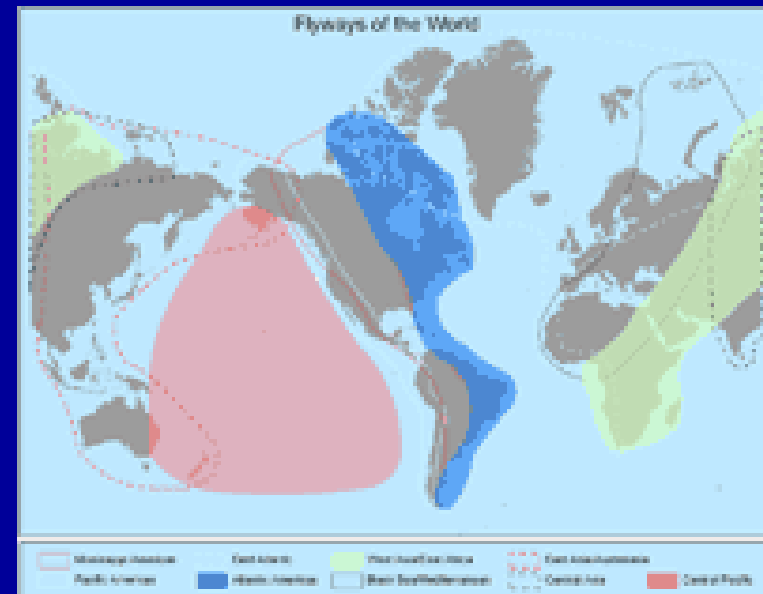


Spread from East Asia

Asia



Illegal trade of poultry products



Infected wild birds

Wild birds






It is the first time in recorded history that HPAI spills over in a significant manner to the wild bird population

Significant isolations of H5N1 from wild birds in E. Asia


- Hong Kong 2002 numerous species of wild birds - Ellis et al 2004
- Japan 2004 - crows, Mase et al 2005
- Mongolia 2005 - migratory waterfowl
- China 2005 - migratory waterfowl Lake Qinghai - Chen et al., 2005; Liu et al., 2005

KEY

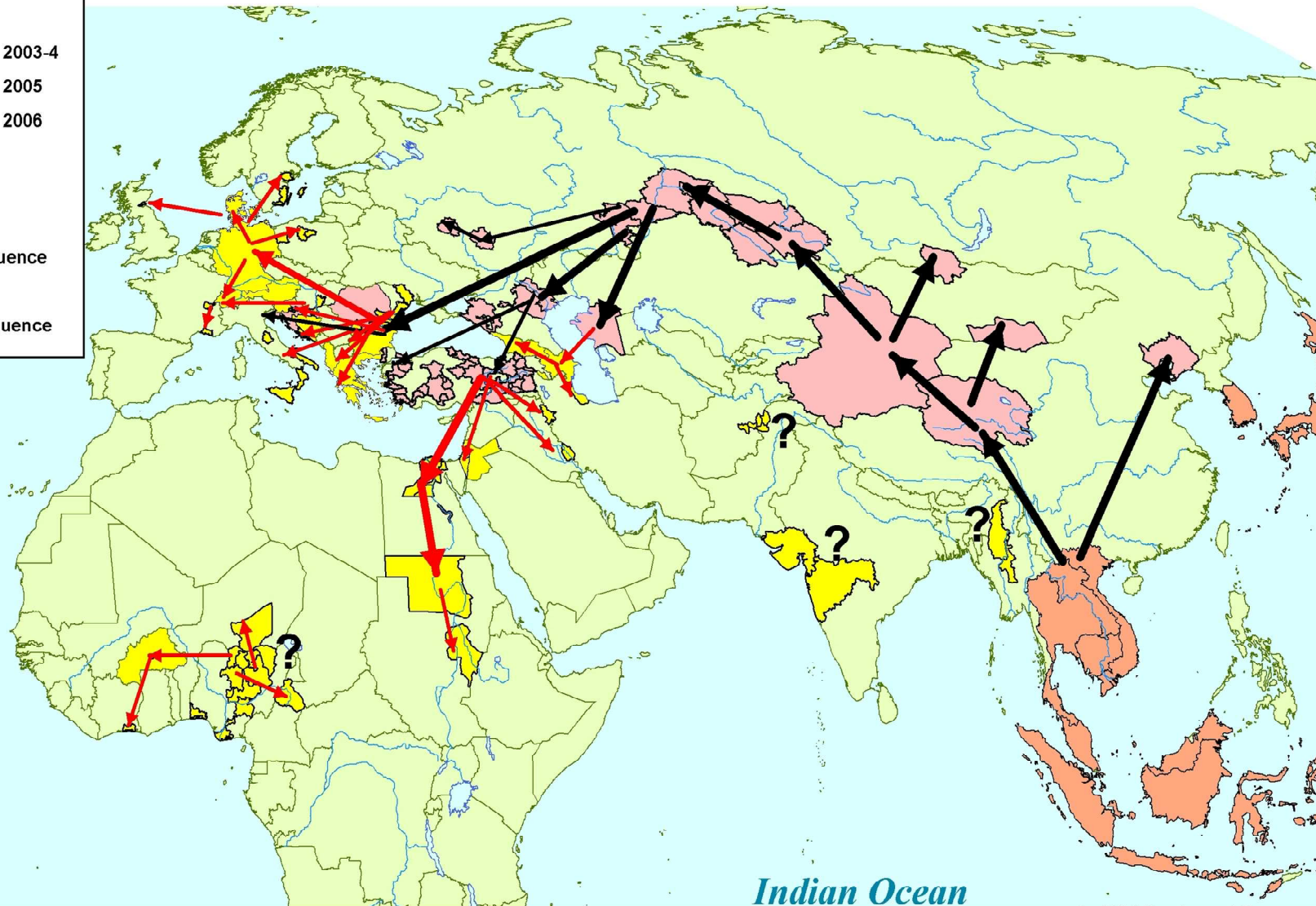
-  New Outbreaks 2003-4
-  New Outbreaks 2005
-  New Outbreaks 2006

? Uncertain

 2005 Sequence

 2006 Sequence

Indian Ocean



Indian Ocean

Possible HPAI H5N1 Dispersal Routes (2005 - 2006)
(Note: Arrows indicate apparent sequence of geographic spread over time)

ArcGIS 8 Development Team
March 2000

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

Robinson Projection

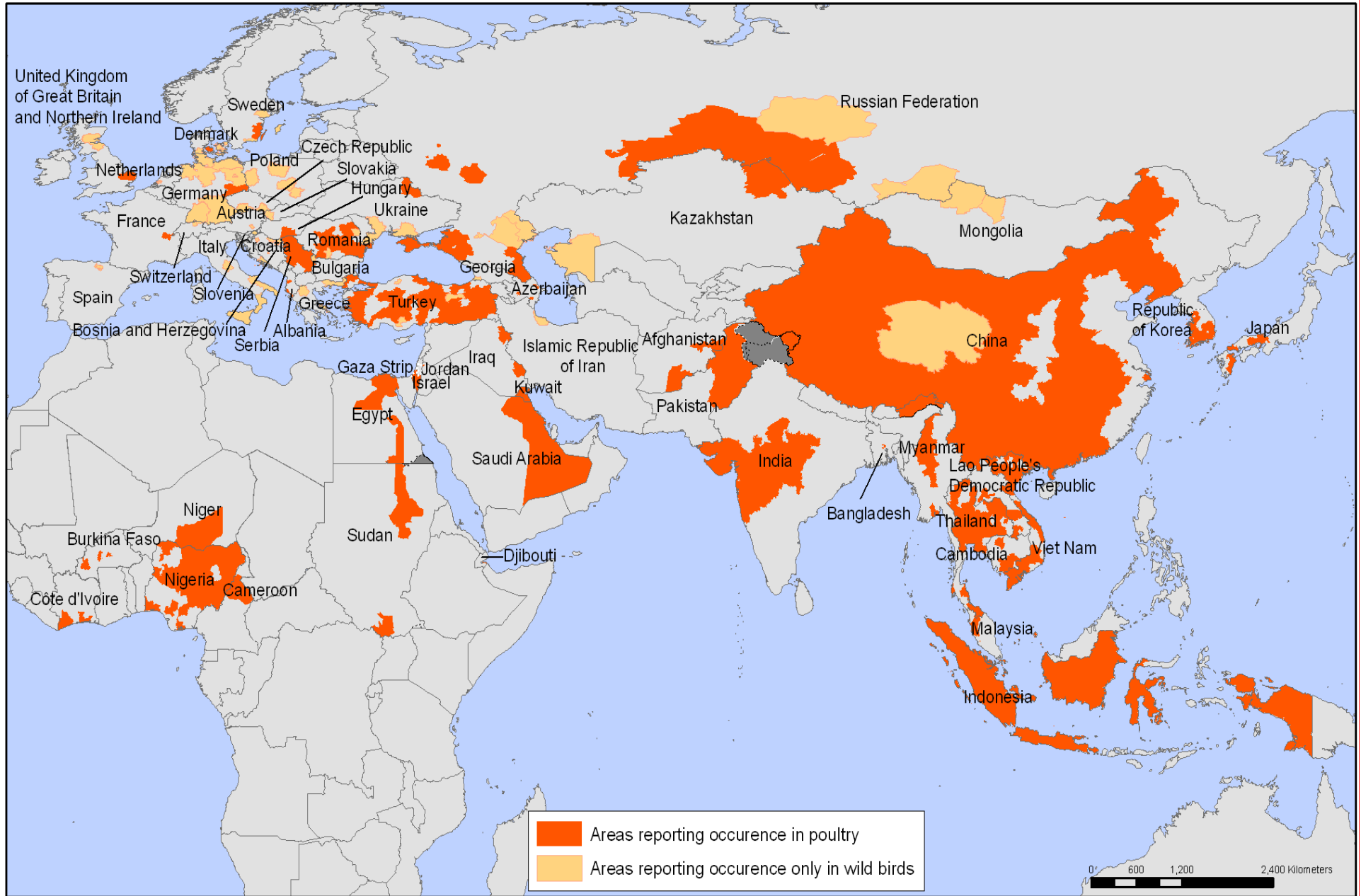
Central Meridian 0.00



ESRI

Areas reporting confirmed occurrence of H5N1 avian influenza in poultry and wild birds since 2003

Status as of 1 April 2007
Latest available update



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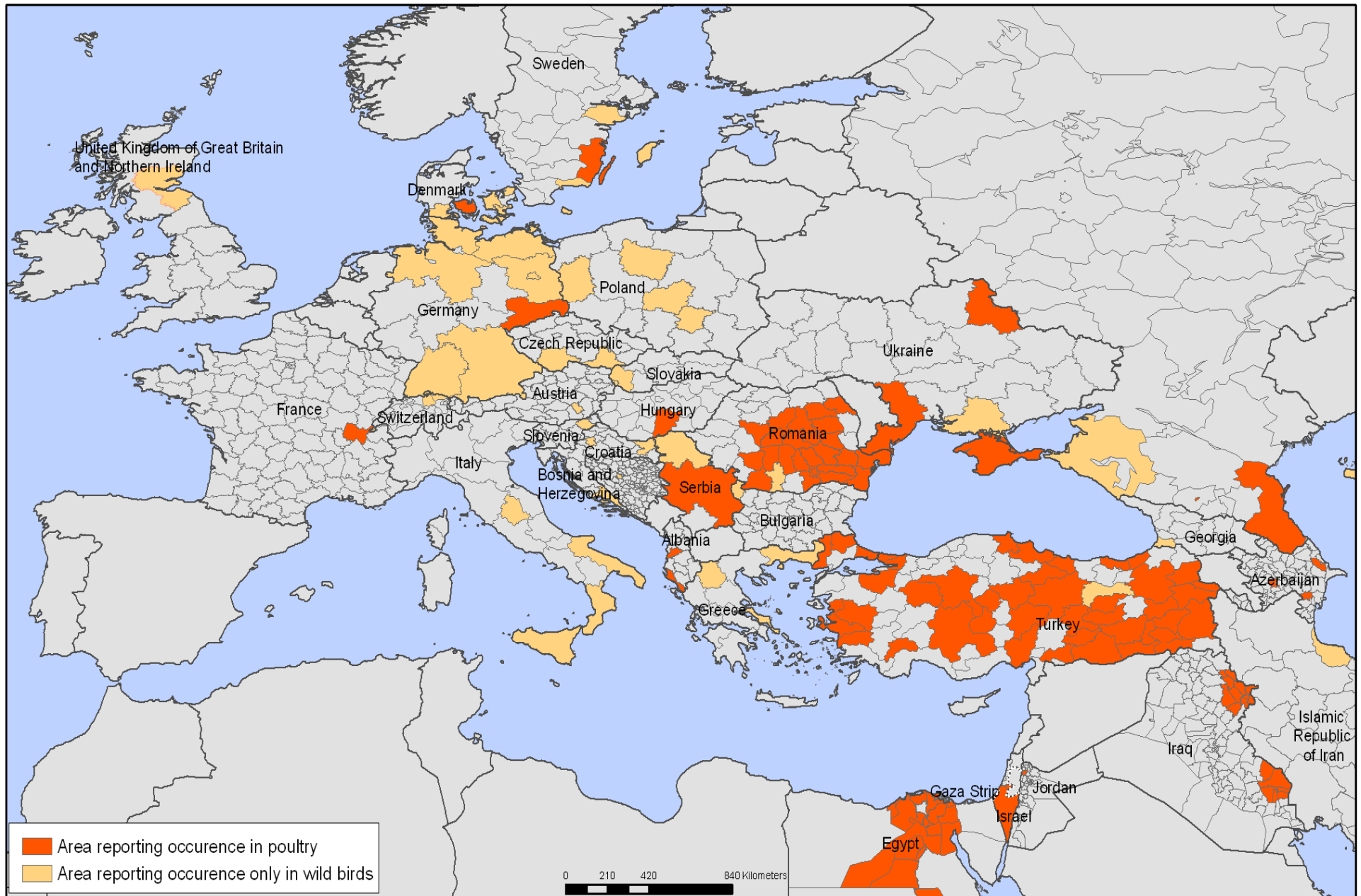
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Data Source: World Organisation for Animal Health (OIE) and national governments

Map Production: Public Health Mapping and GIS

Communicable Diseases (CDS) World Health Organization

Areas reporting confirmed occurrence of H5N1 avian influenza in poultry and wild birds in Europe between January and June 2006



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Mute swans seem to have been responsible for spread of H5N1 in Europe in early 2006

European countries HPAI H5N1 reported in swans January – April 2006

Croatia, Germany, Italy, Austria, Bosnia, Greece. Bulgaria, Slovenia, Hungary, Russia, Poland, Serbia, Sweden, UK [Whooper swan]

and Azerbaijan , Kazakhstan & Iran





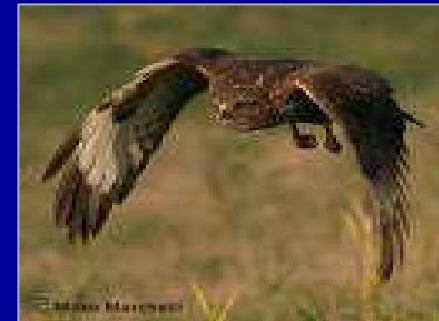
Didier Vangeluwe



H5N1 in other
wild birds in
Europe 2006



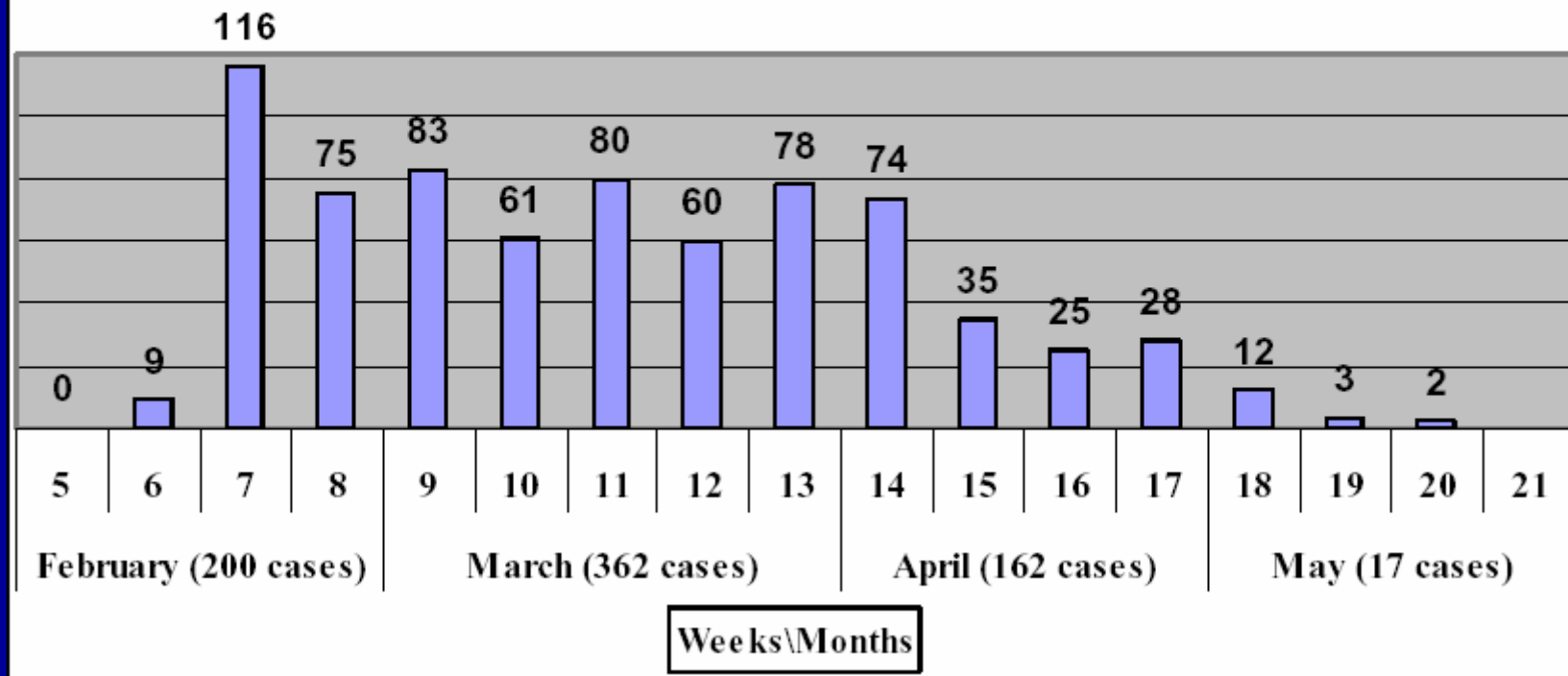
France [pochard], Switzerland,
[goosander], Denmark [buzzard,
tufted ducks, scaup etc], Sweden
[tufted ducks, scaup], Germany -
numerous



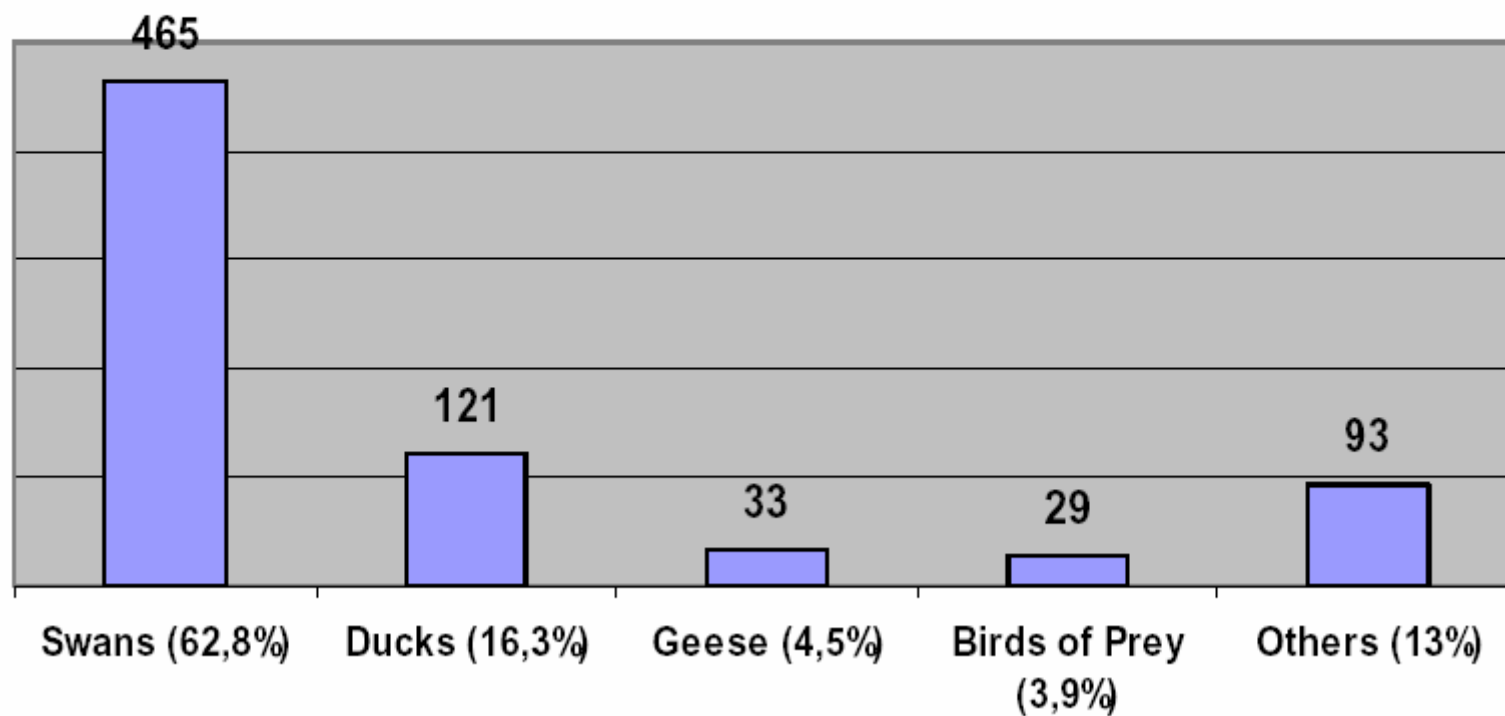
Surveillance for H5N1 in wild birds in the European Union

- In 2005-2006 ~100,000 birds sampled
- Since February 2006 741 positive in 13 member countries
- 4 outbreaks in poultry each stamped out with no further spread
- All viruses genetically close to Lake Qinghai viruses
- No human infections

HPAI cases in wild birds in the MSs - total 741 infected birds
Cases notified to ADNS from 1 February to 21 May 2006



HPAI Cases in wild birds in the MSs - total 741 infected birds
Cases notified to ADNS from 1 February to 21 May 2006



Wild bird surveillance in the EU and in Africa 2006-2007

- Out of a total of 120 000 (EU) and 10 000 (Africa/Middle East) healthy birds sampled
- NONE were found to be infected with H5N1 or any HPAI strain
- It can be believed that the role of wild birds in the ecology and epidemiology of H5N1 is negligible, except for peculiar circumstances occurring in 2005-2006.

The primary means of spread is through trade of infected poultry



AVIAN INFLUENZA AND HUMAN HEALTH

Spanish influenza 1918-1919

20-40 million dead



Nature, Vol. 437, 6 Oct 2005

Taubenberger *et al.*

- “Spanish flu” (H1N1) genome completely sequenced, and has shown:
 - The virus was entirely of avian origin (not a reassortant)
 - Contains some mutations that are present in the genome of the H5N1 Asian virus

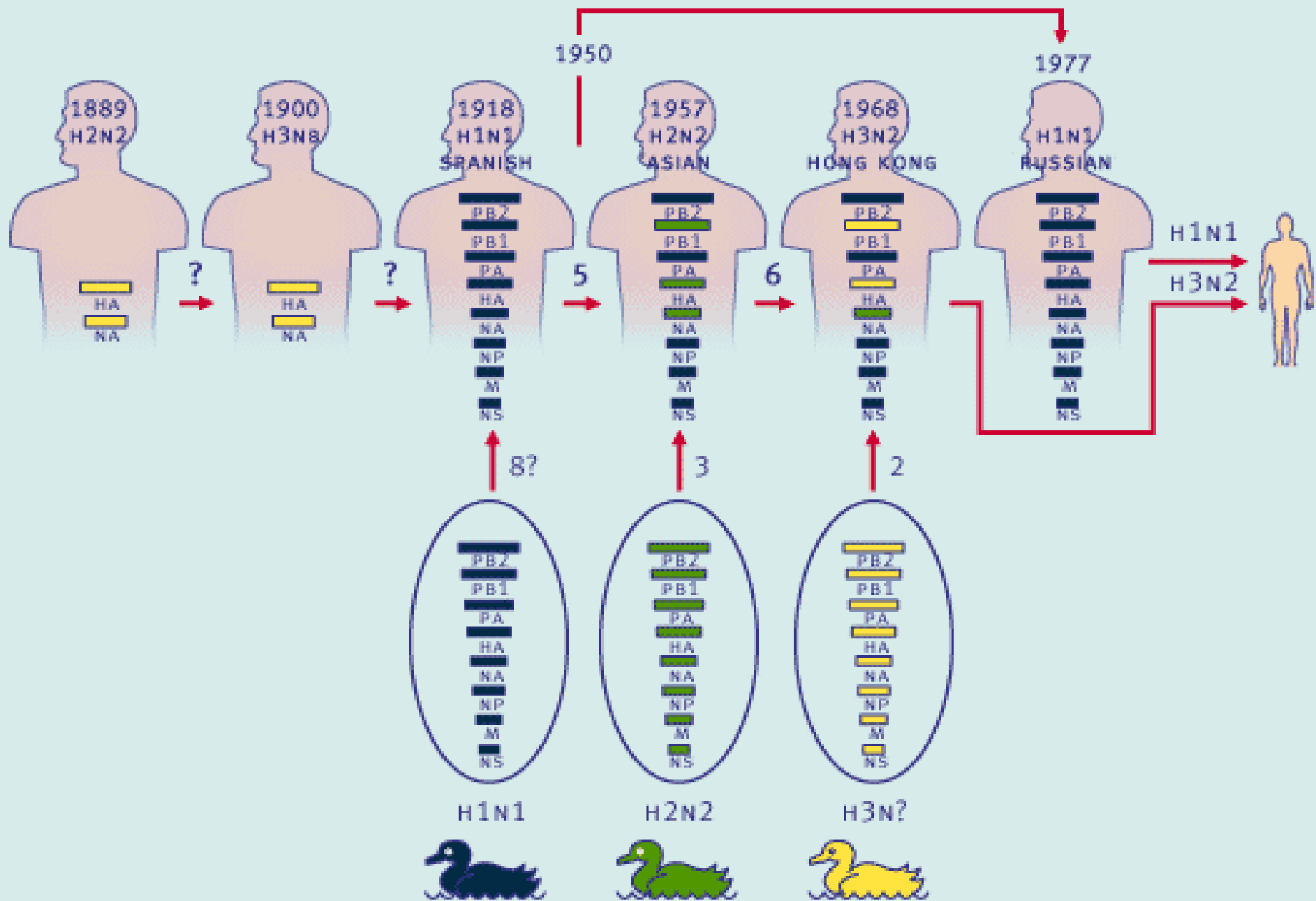
Pandemic potential

- Direct infection of humans with AI
- Generation of a new pandemic virus through genetic reassortment between an avian and mammalian virus

Human pandemic viruses

- All the viruses of the 20th century have an “avian component”
- All human pandemic viruses known to date are H1, H2 or H3 subtype

Origin of human pandemic influenza A viruses



Asian H5N1 in humans

H5N1 in humans in SE Asia

- Of 307 confirmed infections of people with H5N1 in SE Asia since 1997 there have been 186 deaths [$>60\%$]
- Very limited human- to human transmission (one documented family cluster in Indonesia)
- We do not know how many subclinical or mild infections there have been

Influenza as a zoonosis – conclusions/1

- There is a huge reservoir of antigenically variable influenza A viruses in wild birds
- Humans may be infected [rarely?] with these viruses either directly or through intermediate hosts
- This has the potential to result in the emergence of pandemic virus

Influenza as a zoonosis – conclusions/2

- It is 28 years [or some would argue 37 years] since the last pandemic
- The expected occurrence is every 22 years with a range of 9-49 years
- A new influenza pandemic in the near future seems inevitable, but will the subtype be H5? H9? Or perhaps H2?

Most certainly

- The next human pandemic virus will have an avian progenitor or component
- The more AI viruses circulate in birds, the greater the risk of igniting the new pandemic
- H5N1 HPAI will be extremely difficult to eradicate from developing countries, in which it also represents a serious threat for food security

Discussion

- There has been an apparent increase in the outbreaks of HPAI in recent years and in the number of birds affected
- H5N1 has been circulating in Asia since 1997, and has undergone significant changes including multiple reassortments and mutations which increase its pathogenicity for humans
- The number of human cases/year has not increased significantly
- HPAI H5N1 is endemic in poultry in some Asian countries
- Spread by wild birds *AND* poultry has introduced HPAI H5N1 into West Asia, Europe and Africa

Questions

- Although HPAI H5N1 appears to be endemic in some poultry sectors in some Asian countries reports are declining – due to under-reporting?
- Has HPAI H5N1 become endemic in some species of wild bird – in Asia? In Europe?
- What will happen in Africa?
- Will the goal of eradication of HPAI H5N1 ever be achieved or will it, through poor control and rearing and marketing practices, become endemic in many countries just as Newcastle disease has?

Conclusion

- Is, first of all a disease of animals
- Control in the animal reservoir is a prerequisite to the management of the pandemic potential
- Is essential to increase knowledge on AI epidemiology and human health implications

THANKS FOR YOUR ATTENTION

