# Wildlife in an Influenza and One Health Context

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# Presentation Outline

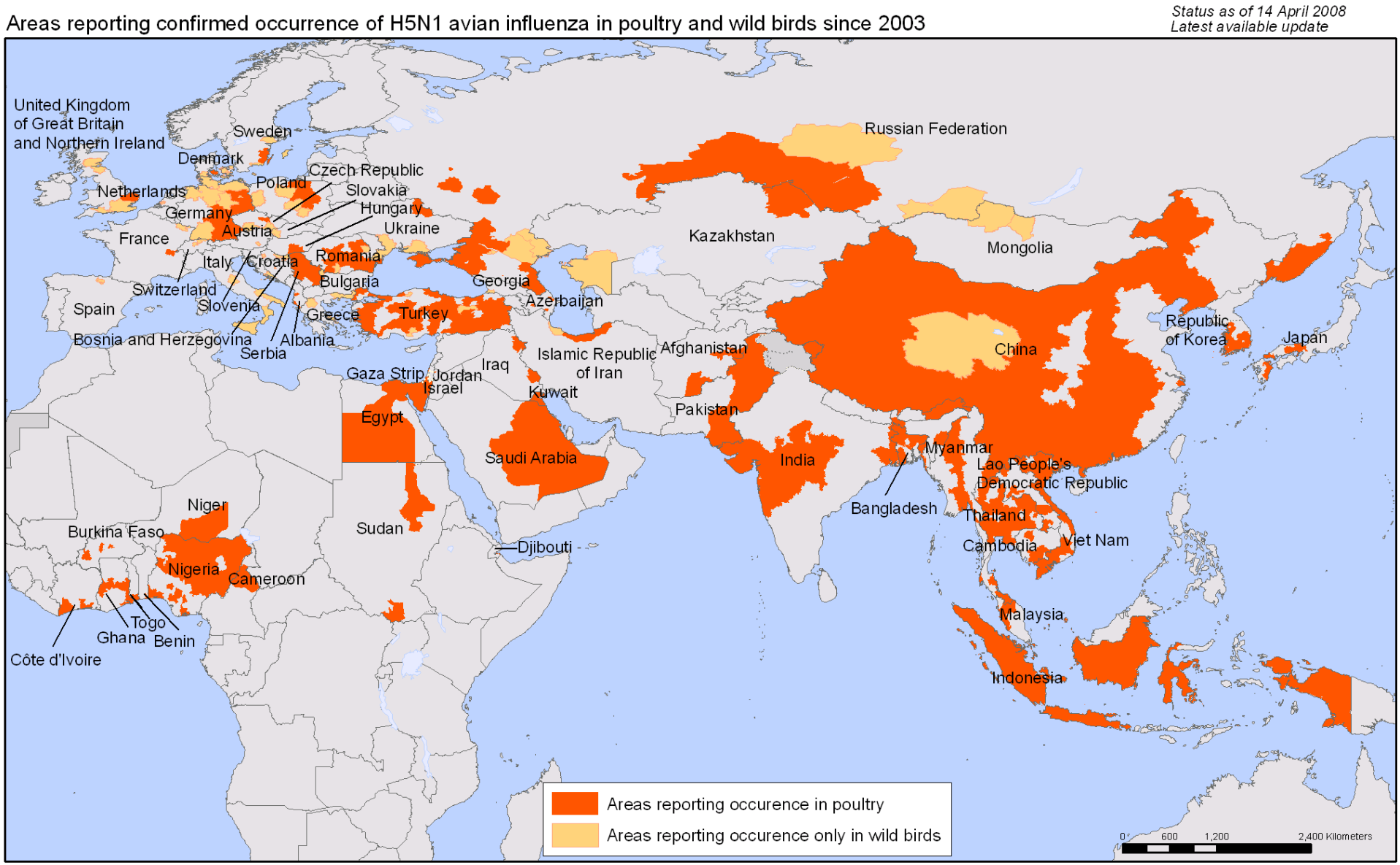
- Zoonotic Diseases
- Lesson learned: HPAI H5N1 in wild birds in Thailand
- Wildlife and Zoonotic diseases
- OIE and Wildlife context
- International collaboration under One Health concept
- Influenza H1N1: an example of One Health approach

# Zoonotic Diseases

- In past 10 years, Emerging pathogens were often Zoonotic
- 60% of more than 1400 human pathogens jump between species
- Examples: Ebola virus, Lyme disease, SARS and Avian Influenza
- Interrelation between Human, Animal and Ecological Health => **One Health**

# Lessons learned: HPAI H5N1 in wild birds in Thailand

# HPAI H5N1: background



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

# HPAI H5N1 Background (Con.)

**Worldwide**

- 504 human cases/ 299 deaths(2003-2010)
- 2010: Cambodia, China, Egypt, Indonesia and Vietnam

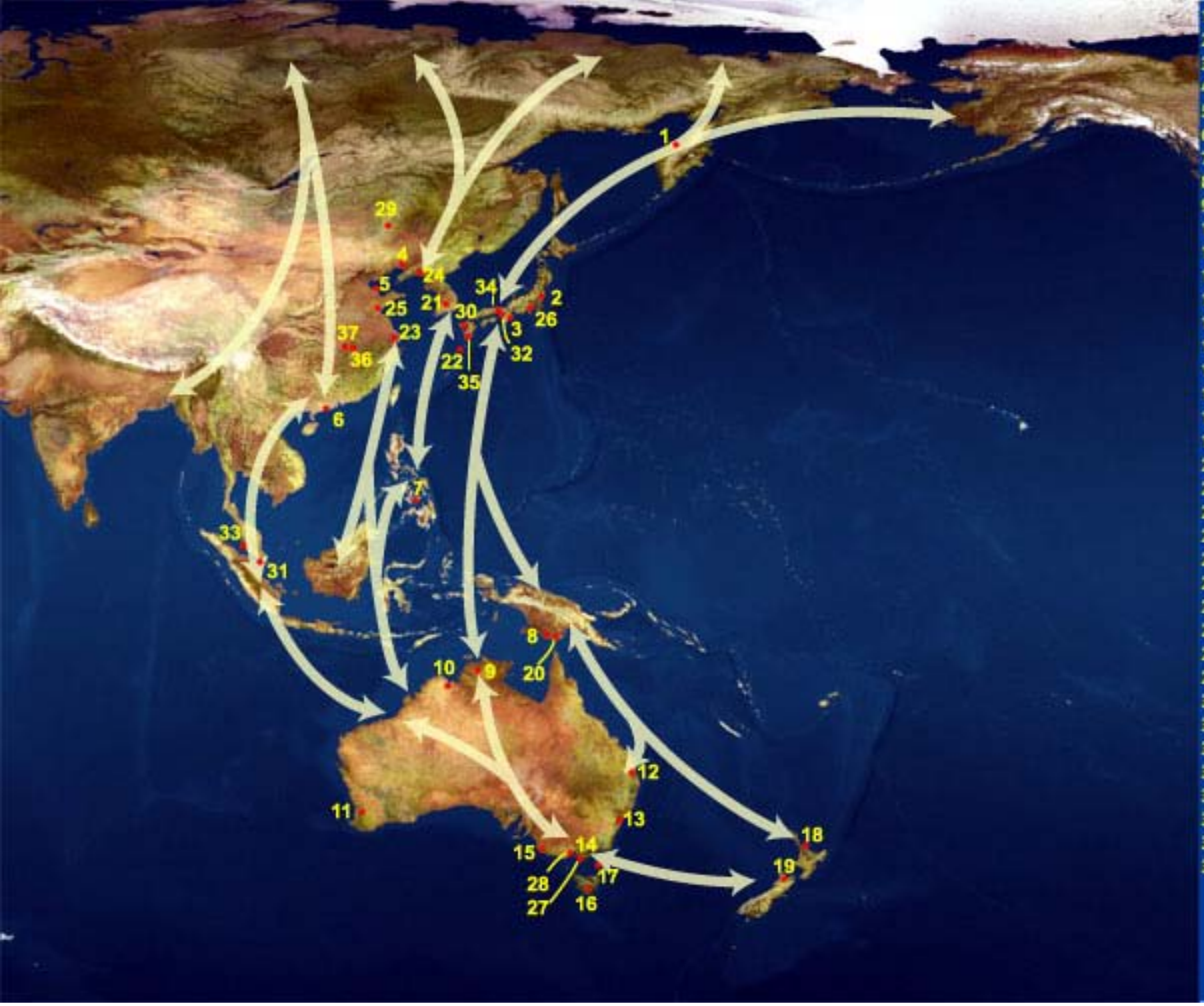
**Thailand**

- December 2003: 2 tigers and 2 leopards die after fed on fresh chicken carcassess
- January 2004: reports on poultry and human cases

# HPAI H5N1 Background (Con.)

**Thailand (con.)**

- 25 Human cases/17 deaths (2004-2006; WHO 2010)
- Animal to human: 14 out of 17 exposed to ill poultry (Beigel et al, 2005/NEJM)
- In 2004, affected poultry populations in 60 of 76 provinces
- > 62 million chicken were culled




- The East Asian-Australasian migratory flyway
- Source: http://www.tasweb.com.au/awsg/eafw.htm

**PhD study: Epidemiology study and risk assessments of highly pathogenic avian influenza H5N1 in free flying birds in Thailand**

- Under collaboration of:
  - Murdoch University, Western Australia
  - Faculty of Veterinary Science, Mahidol University, Thailand
  - Department of National Park, Wildlife and Plant Conservation
  - Department of Livestock Development
  - Funded by
    - AB CRC and
    - FAO RAP

**PhD study: Epidemiology study and risk assessments of highly pathogenic avian influenza H5N1 in free flying birds in Thailand**

## Objectives

- To use existing surveillance data to identify disease patterns and trends of previous outbreaks in wild bird in Thailand
- To identify high risk species involved in the disease transmission from an outbreak area to another area.
- To understand the transmission pathways of avian influenza H5N1 between wild birds and domesticated poultry.
- To undertake a risk assessment of the virus transmission between wild and domestic species in the central part of Thailand


1. Existing survey data
2. Sero-Viro survey
5.Risk assessment
3. Questionnaire
4. Wild bird observation

# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand

## Material and Methods

- National active surveillance program in wild birds authorized by Department of National Park, Wildlife and Plant Conservation
- Samples were separated and submitted to laboratories including the Monitoring and Surveillance center for Zoonotic disease in Wildlife and Exotic animals (MoZWE), Faculty of Veterinary Sciences, Mahidol University
- Passive surveillance from local government and public

# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand (con.)

## Material and Methods (con.)

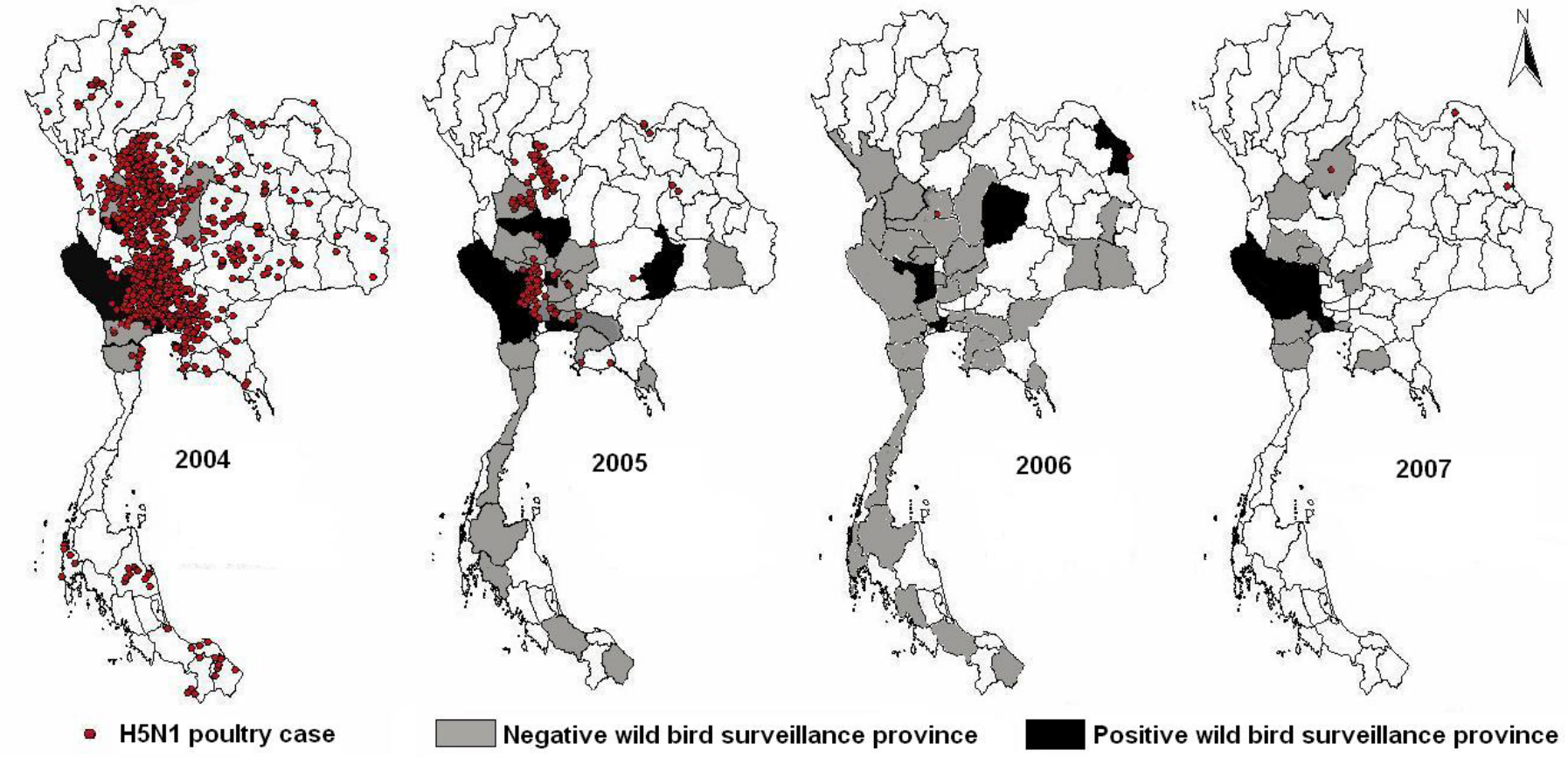
- Swab and carcass samples were processed and tested using:
    - Viral culture in Madin-Darby Canine Kidney Cells (MDCK) cells
    - Hemagglutination (HA test)
    - RT-PCR using specific primer to HA, NA and M genes
- Results were recorded in the MoZWE database

# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand (con.)

Results of the surveillance during 2004-2007

| Year | Positive samples | Total samples | Prevalence | 95%CI |
|---|---|---|---|---|
| 2004 | 15 | 552 | 2.7% | 1.4, 4.1 |
| 2005 | 14 | 2,620 | 0.5% | 0.3, 0.8 |
| 2006 | 13 | 2,070 | 0.6% | 0.3, 1.0 |
| 2007 | 18 | 1,021 | 1.8% | 1.0, 2.6 |
| **Total** | **60** | **6,263** | **1.0%** | **0.7,1.2** |

# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand (con.)



# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand (con.)

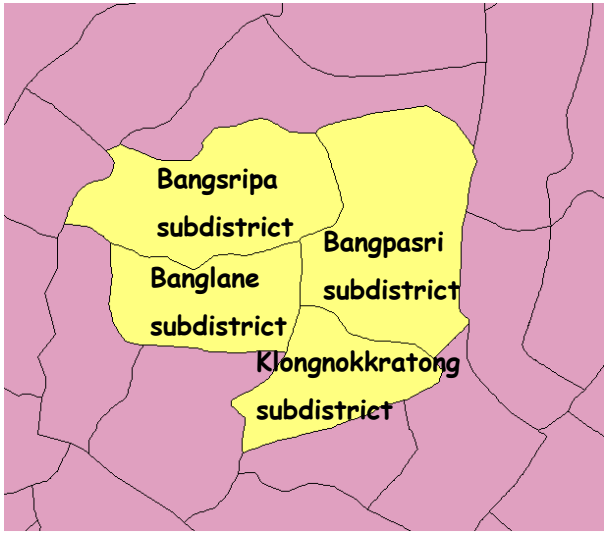
- Prevalence of HPAI H5N1 in wild bird populations decreased from 2004 to 2006 then rose up again in 2007
- Positive wild bird species were mostly residential species (12/16)
- No significant difference between prevalence of waterfowl and non waterfowl groups ($p=0.5$)
- Specimens from carcasses were significant more likely to be positive than swabs ($p<0.0001$)
- Specimens from dead birds were significant more likely to be positive than healthy appearance ($p<0.0001$)

# 1. Analysis of an existing wild bird surveillance data for H5N1 virus in Thailand (con.)

- Some wild bird species were less susceptible to the virus than others
- Positive wild bird samples only found in provinces where poultry outbreaks had occurred
- In some provinces, the virus was detected in wild birds up to three years after infected domestic poultry were eradicated
- Similar to poultry outbreaks, positive wild bird samples increased significantly during winter

# Study site for pilot studies

Banglane District,
Nakornpratom province



# 2. Surveillance program for HPAI H5N1 virus in wild birds

## Material and Methods

- Wild birds were sampled every two months (swab, serum and carcass samples) min 30 birds (Feb 07- Oct 08)
- Serum samples were tested by Neutralization test (NT)
- Swab samples and carcasses were tested by MDCK cell culture, HA test and RT PCR

# 2. Surveillance program for HPAI H5N1 virus in wild birds

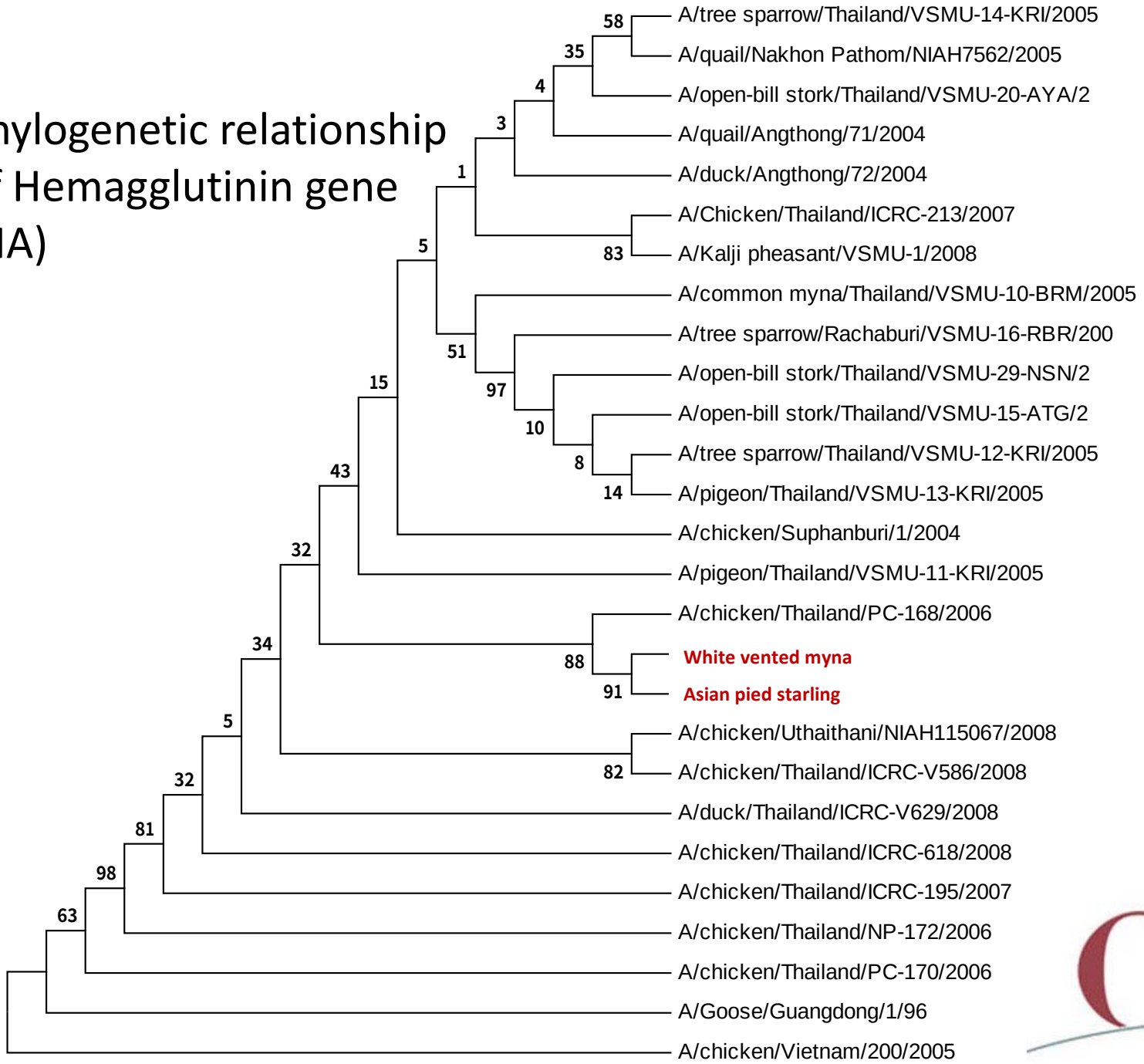
## Results

- Seroprevalence as tested by the H5N1 serum NT was 2.1% (8 out of 385)
    - Rock pigeon (*Columba livia*)
    - Asian pied starling (*Gracupica contra*)
    - Spotted dove (*Streptopelia chinensis*)
    - Oriental magpie robin (*Copsychus saularis*)
    - Blue-tailed bee-eater (*Merops philippinus)*,
    - Myna (*Acridotheres spp.*)
    - Pond heron (*Ardeola spp.*).

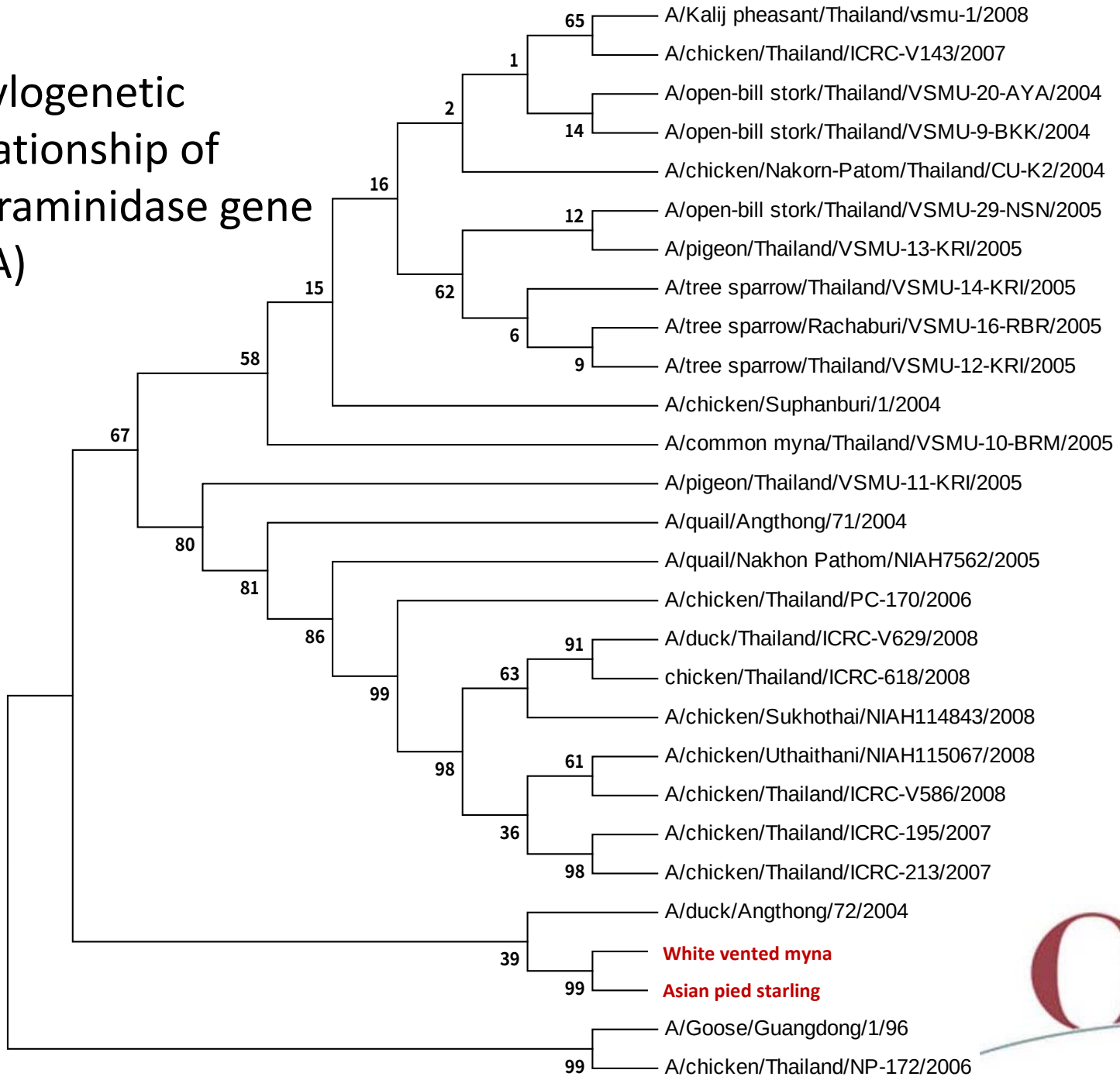
# 2. Surveillance program for HPAI H5N1 virus in wild birds (con.)

- Prevalence of viral detection was 0.5% (2 out of 421 samples; with 95%CI 0.0, 1.1). Positive samples were from Asian Pied Starling (*Gracupica contra*) and White vented Myna (*Acidotheres grandis*).


# Phylogenetic relationship of Hemagglutinin gene (HA)



# Phylogenetic relationship of Nuraminidase gene (NA)



# 2. Surveillance program for HPAI H5N1 virus in wild birds (con.)

Results

- HA genes of both viruses found in this study were most closely related to the H5N1 virus (A/chicken/Thailand/PC-168/2006) isolated on July, 23rd 2006 from a chicken in Pichit province
- NA genes of both viruses were clustered in a group of Thai H5N1 viruses isolated between 2004 and 2005
- No poultry outbreak/case reported in the area during the time of this study

# 2. Surveillance program for HPAI H5N1 virus in wild birds (con.)

Results (con.)

- Infection mostly detected in resident/non migratory birds
- Transmission was likely from poultry to wild birds (based on phylogenetic analysis)
- Possible explanation:
    - Silent outbreak in poultry??
    - Poultry case with no report in the area or
    - Poultry and/or fomite movement ??

# 3. Questionnaire study

## Material and Methods

- 239 villagers/households from the 30 villages
- Questions;
  - General information
  - Farm structure and practises
  - Experience on HPAI H5N1 infection and other diseases
  - Wild birds and their interactions with poultry
  - Concern and awareness
- Data analysis using SPSS and Excel
  - Descriptive analysis
  - Logistic regression

# 3. Questionnaire study (con.)

Results

- Most of villagers owned native chickens/fighting cocks with few owning commercial poultry such as layers or ducks
- Farm structure and practises were varied depending on purpose of keeping poultry and poultry number
- Wild birds observed in poultry keeping areas were mostly resident/ non migratory birds
- Interaction between wild and domestic birds were observed

# 3. Questionnaire study

Results (con.)

**Risk factors:**

- Buying cocks from low biosecurity farm
- Replacing bird individually
- Presence of **lesser whistling ducks** in farms

**Protective factor:**

- Selecting healthy birds when buying poultry

# 4. Wild bird observation study

## Material and Methods

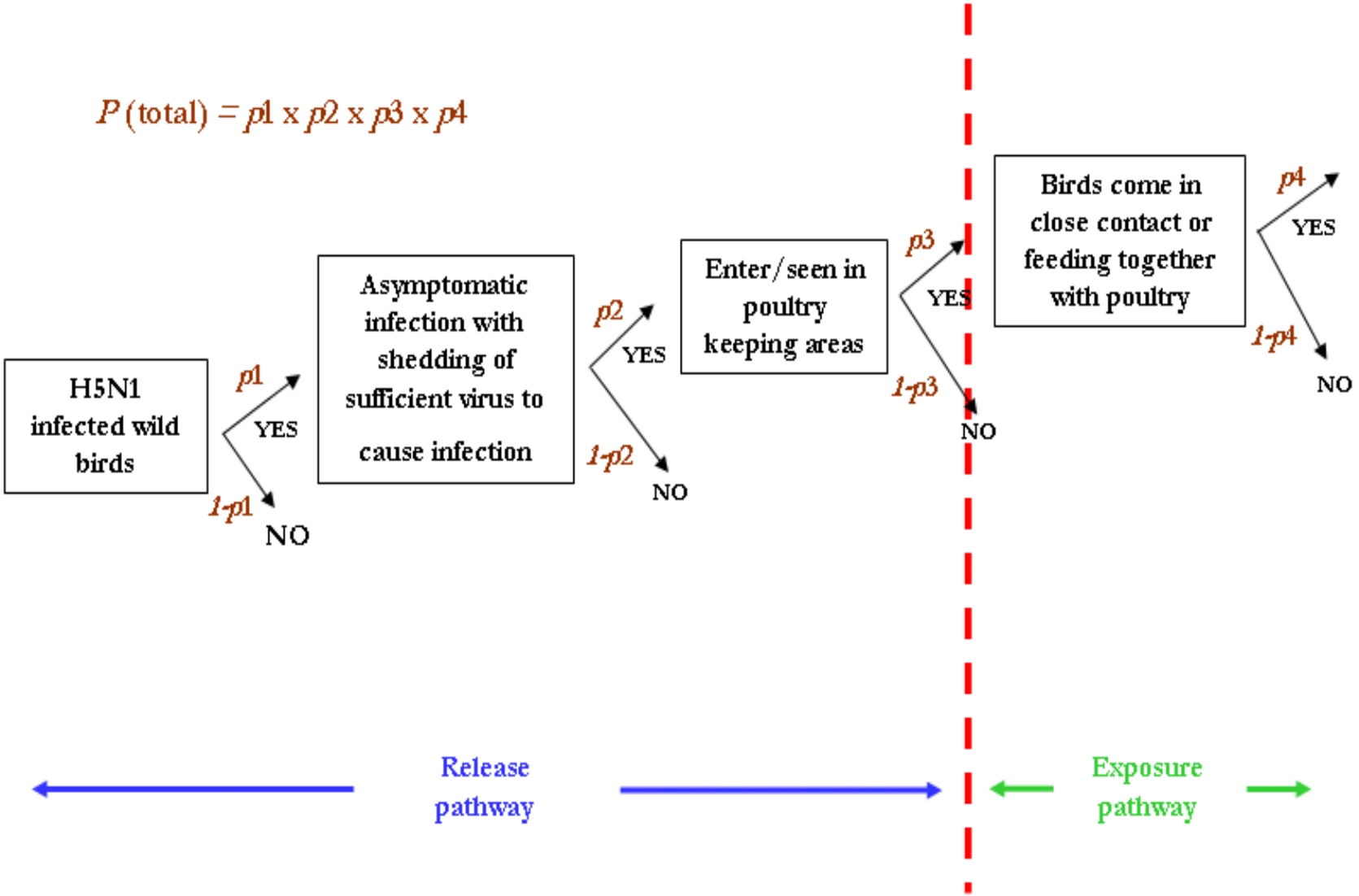
- Observation sites
  - 2 Wild bird nesting/roosting sites
  - 2 wild bird feeding sites
  - 2 Poultry keeping sites
  - 2 Poultry farms (open system)
- Observed twice a month
- 30 mins for each visit/ 8 period of time (6.00am-6.00pm)
- Total of 24 visits per site

# 4. Wild bird observation study (con.)

Results

- Mostly common terrestrial species
- Interactions between wild and domestic animals observed esp. open system poultry farm
- High risk areas are opened system farms

# 5.Risk assessments of transmission of H5N1 virus from wild birds to poultry



# 5.Risk assessments of transmission of H5N1 virus from wild birds to poultry

## Qualitative assessment

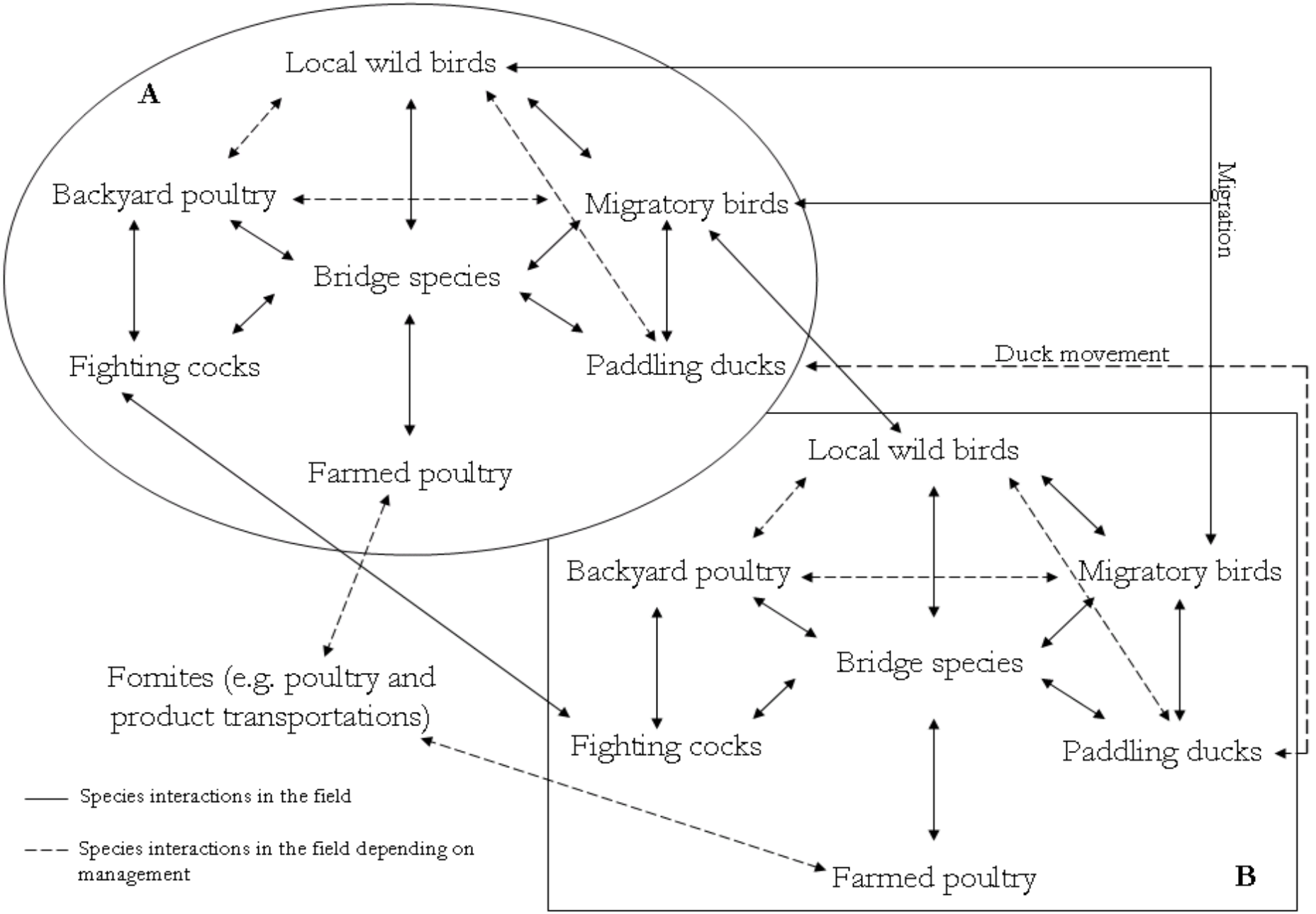
- Risk of an infected wild bird defaecating an infectious dose of HPAI H5N1 virus close to a domestic poultry in poultry keeping areas was “Low”
- Moderate severity

## Quantitative assessment

- Risk of an infected lesser whistling duck defaecating an infectious dose of HPAI H5N1 virus close to a domestic duck in an open system duck farm was $5.8 \times 10^{-6}$
- $2.5 \times 10^{-1}$ per year

# Conclusion and Recommendations

- HPAI H5N1 outbreaks in Thailand likely to cause by poultry movements and their activities while wild birds help spreading and maintaining the viruses.
- Spill back VS Spill over of the virus between wild and domestic birds are likely to occur if the virus exist in the fields.
- Surveillance and monitoring programmes should be in place
- Communication and education session for small poultry holders should be encouraged to raise awareness in order to improve their farm bio-security as they likely to contain higher risks
- Emerging and Re-emerging influenza preparation plans
- Improve farm biosecurity to prevent diseases


A
Local wild birds
Backyard poultry
Migratory birds
Bridge species
Fighting cocks
Paddling ducks
Farmed poultry
Migration
Duck movement
Fomites (e.g. poultry and product transportations)
Local wild birds
Backyard poultry
Migratory birds
Bridge species
Fighting cocks
Paddling ducks
Farmed poultry
B
Species interactions in the field
Species interactions in the field depending on management

# Wildlife and Zoonotic diseases

- SARS: Bat, Civet cats
- Nipah: Bats, Pigs
- Hendra virus: Bats, Horse
- Australian Bat Lyssavirus: Bats
- Japanese Encephalitis: Water birds, Pigs
- Rabies: Bats, monkeys, raccoons, foxes, cattle, wolves, coyotes, mongoose, etc
- Etc.

# OIE and Wildlife context

Possible theories for this increased transmission of pathogens across the species divide include:

- Expanding human populations with increased contact with wild animals,
- Wildlife associated microbes entering livestock-based agricultural systems,
- Intensification of wildlife farming,
- Increasingly mobile human populations,
- Increased movement of animals and animal products via international trade

# OIE and Wildlife context (con.)

"There is clearly a duty to manage wildlife diseases. We must maintain biological diversity, improve our knowledge of the health status of all animal populations and prevent species at risk from disappearing, while protecting human and domestic animal populations from the introduction of diseases."

**Dr Bernard Vallat (2008)**

# OIE and Wildlife context (con.)

- A permanent Working Group (WG) on wildlife diseases established in 1993
    - Comprises 6 world-leading scientific experts in their subject areas coming from all regions of the world.
    - Analysed and disseminated information on almost 40 diseases affecting wildlife in the wild or in captivity.
    - Prepared OIE recommendations and oversees numerous scientific publications on the surveillance and control of the most important specific wildlife diseases.
- The WG meet once a year: February 2010

# OIE and Wildlife context (con.)

- National wildlife focal points
  - To declare to the OIE the notifiable diseases affecting wildlife
  - To submit comments to the proposals of new standards in the filed of wildlife diseases

Next meeting: Regional Asia-Pacific Wildlife focal points on 5-7 Oct 2010 in Bangkok

# International collaboration under One Health concept

- Manhattan Principle (2004)
  - Workshop organized by WCS at Rockefeller University in New York
  - Health experts worldwide: to discuss on the movement of diseases among human, domestic animal and wildlife population
  - 12 recommendations aim to prevent epidemic / epizootic disease and maintain ecosystem integrity

# International collaboration under One Health concept (con.)

**A Strategic framework for Reducing Risks of Infectious Disease at the Animal – Human – Ecosystems Interface** (2008) produced by FAO, OIE, WHO, UN, Unicef and the World Bank

- Objective of the strategic framework:
  - To minimise the global impact of diseases of animal origin, including zoonoses, especially those with pandemic potential.

# Influenza H1N1: an example of One Health approach

Mexico

- The Global Early Warning and Response System for Transboundary Animal Diseases (GLEWS), the joint system combining and coordinating the alert and response mechanisms of the OIE, FAO and WHO reported on detection new strain on 24 April 2009
- A mission team under collaboration of OIE, FAO,CDC, USDA and OIRSA operated on 29 April 2009 to assess the potential linkage to pigs, strengthen laboratory diagnostic capacity and enhance animal disease surveillance activities

# Influenza H1N1: an example of One Health approach (con.)

- The mission team worked closely with the Maxican Veterinary Services, liaise with WHO and national public health teams.

<u>SEA region</u>

- Ongoing surveillance in Pigs in the region by FAO, AAHL and Murdoch University

# Thank you for your attention