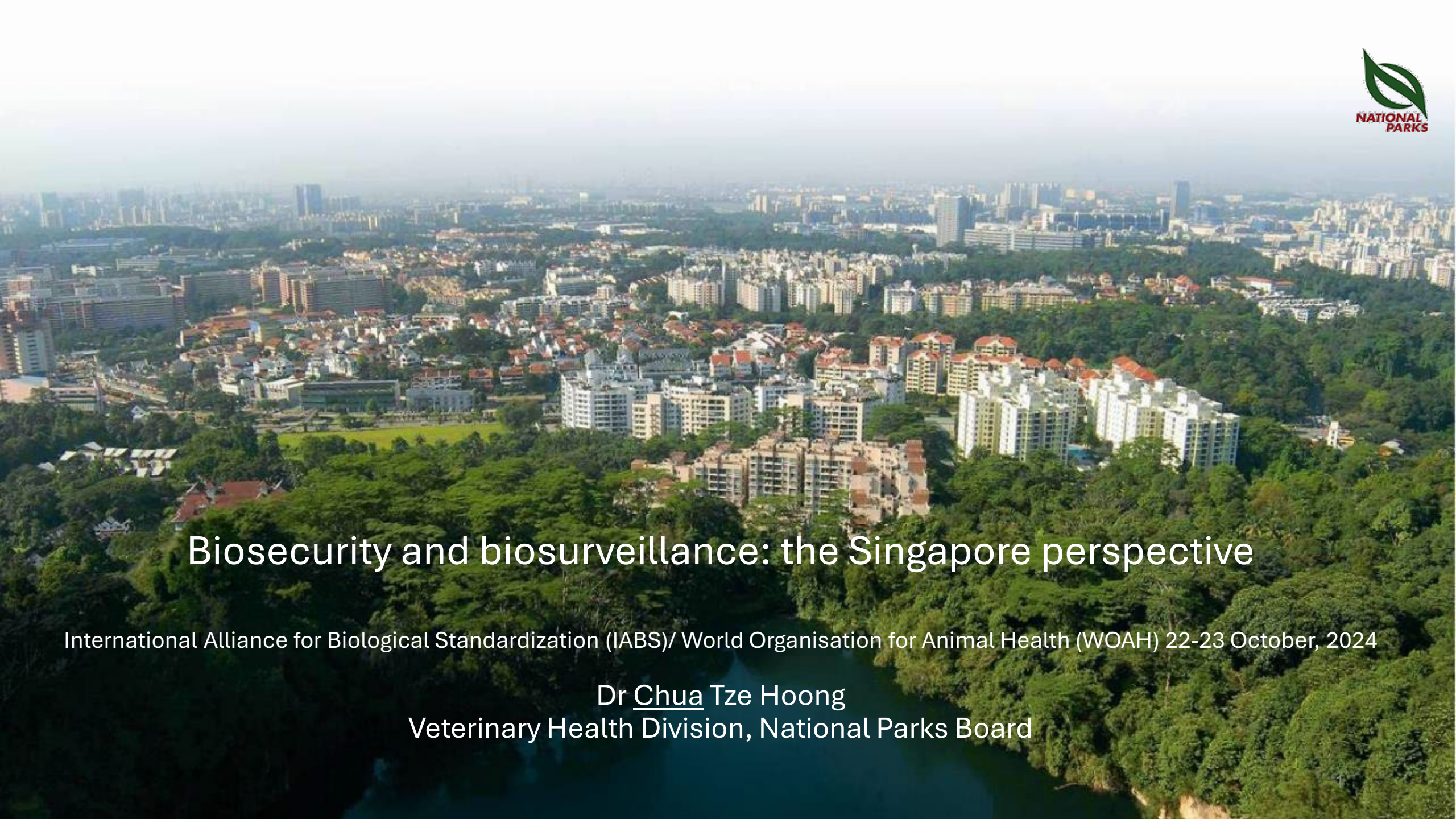


Biosecurity and biosurveillance: the Singapore perspective

International Alliance for Biological Standardization (IABS)/ World Organisation for Animal Health (WOAH) 22-23 October, 2024

Dr Chua Tze Hoong
Veterinary Health Division, National Parks Board

Animal & Zoonotic Diseases at our Doorstep

FMT

Malaysia records first incidence of African horse sickness

FMT Reporters - 04 Sep 2020, 09:59 AM

Investigations are ongoing to determine the source of infection in Terengganu.

143 SHARES 119 8 16 0

Total Views: 6

The five Terengganu horses were tested positive for African horse disease after a second sampling on Aug 31. (Bernama pic)

NEW STRAITS TIMES

Sarawak to go door-to-door to vaccinate more dogs against rabies

By Bruno J
April 27, 2024 @ 12:45pm

Service no longer available

Since 2017, Sarawak has seen an outbreak of rabies, with 78 cases involving humans recorded, resulting in 71 deaths. - File Pic

November 16, 2021
4:23 PM GMT+8
Last Updated 5 months ago

Healthcare & Pharmaceuticals

Japan confirms H5N8 strain in third bird flu outbreak in the country

Asia / Southeast Asia

Bird flu kills 11-year-old girl in Cambodia, first human case in country since 2014

- The girl from rural Prey Veng became ill on February 16 and was sent to hospital in Phnom Penh, where she died on Wednesday
- Bird flu poses a high risk to children who may be feeding or collecting eggs, playing with the birds or cleaning their cages

DVSS: Samples from pigs that died in Ng Ngungun confirmed positive for African Swine Fever

BY PETER BOON ON APRIL 16, 2022, SATURDAY AT 2:15 PM

SARAWAK

Lion at Singapore Zoo tests positive for COVID-19; five lions now infected

THE STRAITS TIMES

Wild boar carcasses in more parts of Singapore test positive for African swine fever

Lumpy Skin Disease confirmed in Sumatra, raising alert for Australia

Dr Ross Ainsworth, 03/03/2022

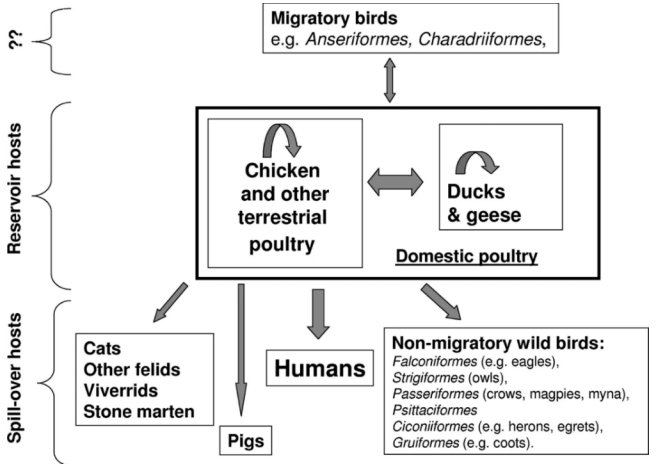
Singapore has seen its first case of Lumpy Skin Disease (LSD) in March 2022, and African Swine Fever (ASF) in February 2023.

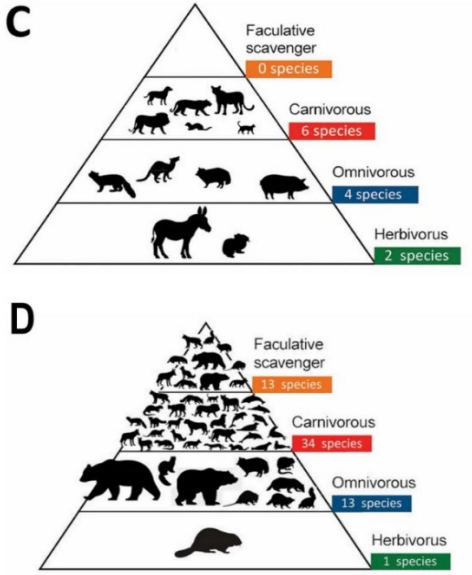
Emergence of A(H5N1) 2.3.4.4b viruses

- In 2020, a specific lineage of A(H5N1) clade 2.3.4.4b emerged and began to spread worldwide
  - Panzootic from 2020-present
  - Within Jan 2022 – Sep 2023, over 17,000 outbreaks reported worldwide

- Unprecedented disease characteristics:
  - Rapid expansion of geographical range into new regions (Americas, Antarctica)
  - Widespread infection of wild birds
  - Significant expansion of host range to new avian species and even mammals
  - Outbreaks became year-round (previously seasonal)

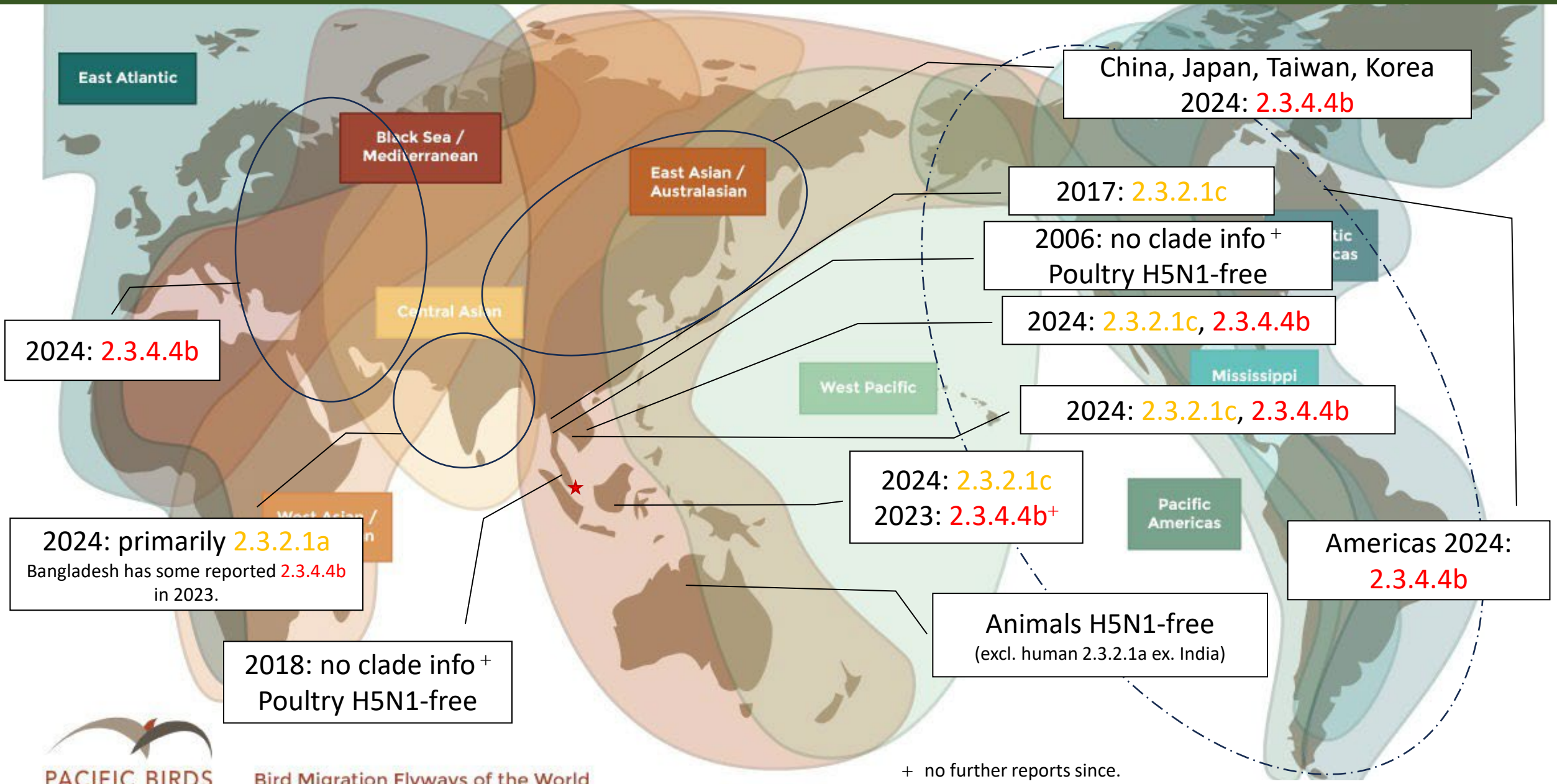
- 2.3.4.4b is currently the dominant circulating lineage in most regions of the world





C, mammal species with reported infections 2003-2019; **D**, mammal species with reported infections 2020-2023. Figures adapted from Plaza et al. (2023)

Global Avian Influenza Situation



PACIFIC BIRDS
HABITAT JOINT VENTURE

Bird Migration Flyways of the World

\+ no further reports since.

Strains reported to best ability via NextStrain and literature search.

Image by Pacific Birds Habitat Joint Ventures. Source: US Fish and Wildlife Service

Multi-layer Approach to Ensure Animal Health

Layer

Pre-Border
Anticipate and assess upstream risks as part of forward defense

Border
Safeguard border biosecurity during the import of live animals and animal products into Singapore

Post-Border
Prevent, detect, respond, recover, and mitigate threats in local animal populations

Risk Drivers

1. Singapore is a **transit point** for migratory wildlife, and import and export of animals and animal products.
2. Increased likelihood for disease due to **global risk drivers** (e.g., climate change, international trade and travel, including smuggling)
3. Increase in **animal/ wildlife populations**, establishments, displacements and interactions
4. Scope for closer and enhanced **One Health collaboration**

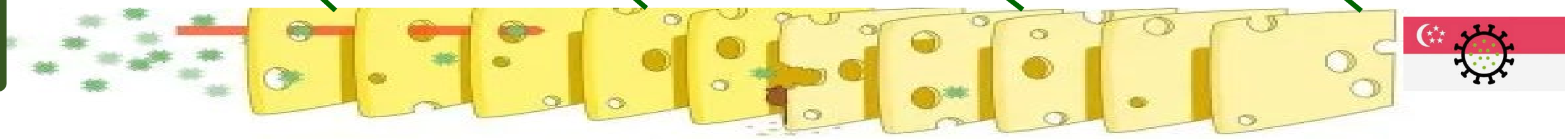


Image Source: University of Nebraska

5

Multi-layer Approach to Ensure Animal Health – HPAI example

Pre-border

- Maintaining HPAI free imports through health certificates, source accreditation, zoning and compartmentalization arrangements
- Horizon scanning – for early detection of overseas disease events

Border

- Border checks via inspection all imports of poultry, birds, eggs and avian products at the port of entry
- Working with border authorities to curb smuggling of birds and avian products, at borders and checkpoints
- Sampling and biosurveillance at border

Post-border: Farm biosecurity, biosurveillance, contingency plans, vaccination

- Maintenance of farm biosecurity through licensing conditions and regular inspections
- Sampling and biosurveillance of local bird populations, including wild birds and migratory shorebirds
- HPAI contingency plans (e.g. stamping out)

Key Biosurveillance Functions and Programmes

- Monitor diseases in local animal populations
- NParks centres also serve as sentinels for biosurveillance

scientific reports

OPEN

Shorebirds wintering in Southeast Asia demonstrate trans-Himalayan flights

David Li, Geoffrey Davison[1], Simeon Lisovski[2], Phil F. Battley[3], Zhijun Ma[4], Shufen Yang[1], Choon Beng How[1], Doug Watkins[5], Philip Round[6], Alex Yee[1], Vupasana Srinivasan[1], Clarice Teo[1], Robert Teo[1], Adrian Loo[1], Chee Chiew Leong[1] & Kenneth Er[1]

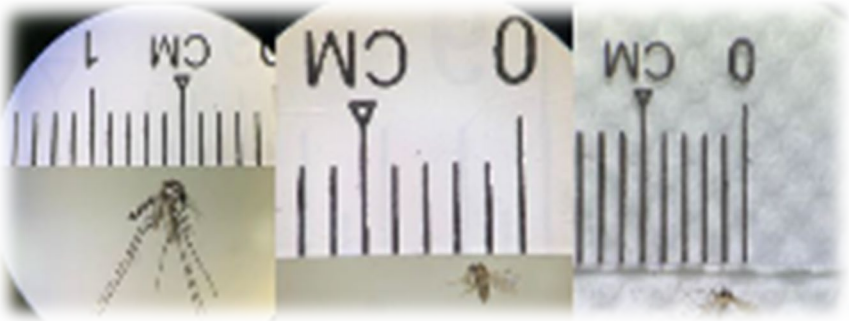
CASE REPORT

Suspected clinical toxoplasmosis in a 12-week-old puppy in Singapore

Audrey Chen[1*], Max Boulay[2], Stacy Chong[3], Kelvin Ho[4], Amy Chan[3], Jasmine Ong[3], Charlene Judith Fernandez[3], Siow Foong Chang[5] and Him Hoo Yap[6]

Key Biosurveillance Functions and Programmes

Vector surveillance for ticks, midges, sandflies that transmit vector-borne diseases e.g. African Horse Sickness (AHS), leishmaniasis, lumpy skin disease



INTEGRATED BIOSURVEILLANCE FOR EMERGING VECTOR-BORNE DISEASES: FIRST DETECTIONS OF CANINE LEISHMANIASIS IN SINGAPORE

Wendy Sng[1], Cheong Huat Tan[2], Stacy Chong[3], Majhalia Torno[2], Kelvin Ho[1], Denise Tan[2], Hwee Ping Lim[1], Jasmine Ong[3], Darren Yeo[3], Amy Chan[3], Zhan Pei Heng[1], Kelvin Lim[1], Tze Hoong Chua[4], Charlene Judith Fernandez[3], Siow Foong Chang[5], Him Hoo Yap[6]

[1]Biorisk and Biosurveillance Branch, Animal and Veterinary Service (AVS), National Parks Board (NParks), 52 Jurong Gateway Rd, Singapore 608550; [2]Environmental Health Institute, National Environment Agency, 11 Biopolis Way, Singapore 138667; [3]Centre for Animal & Veterinary Sciences, AVS, NParks, 6 Perahu Rd, Singapore 718827; [4]Veterinary Health, AVS, NParks, 52 Jurong Gateway Rd, Singapore 608550; [5]Professional and Scientific Services, AVS, NParks, 52 Jurong Gateway Rd, Singapore 608550; and [6]Animal and Veterinary Service, NParks, 1 Cluny Road, Singapore Botanic Gardens, Singapore 259569

EMERGING INFECTIOUS DISEASES®

ISSN: 1080-6059

EID Journal > Volume 28 > Number 12—December 2022 > Main Article

Volume 28, Number 12—December 2022

Research

Development of Differentiating Infected from Vaccinated Animals (DIVA) Real-Time PCR for African Horse Sickness Virus Serotype 1

Yifan Wang, Jasmine Ong, Qi Wing Ng, Tanapat Songkasupa, Eileen Y. Kobra, Jeslyn P.S. Wong, Kanokwan Ruangjinda, Charlene Judith Fernandez, Taoq
Author affiliatior
Huangfu, S.F. Ch
Health Institute,
Cite This Article

BRIEF REPORT **Open Access**

Detection of a novel *Babesia* sp. in *Amblyomma javanense*, an ectoparasite of Sunda pangolins

Stacy Q. Y. Chong[1*], Darren Yeo[1], Nur Insyirah Aidil[1], Jasmine L. Y. Ong[1], Amy H. J. Chan[1], Charlene Judith Fernandez[1], Bryan T. M. Lim[2], Max D. Y. Khoo[2], Anna M. S. Wong[2], Siow Foong Chang[1] and Him Hoo Yap[1]

Disease Investigation and Response

- To <u>detect and characterise</u> emerging animal health threats in Singapore
- May be complemented with subsequent epidemiological and ecological modelling, and laboratory investigations to guide risk assessment and management measures


THE STRAITS TIMES

AVS, NEA investigating spike in leptospirosis infections among dogs in Upper Thomson area

Symptoms of leptospirosis in dogs can include fever, vomiting, diarrhoea and an inability to pass urine. PHOTO: PEXELS

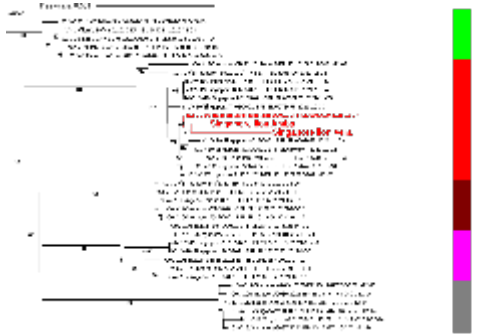
Rabbit Haemorrhagic Disease

Rabbit haemorrhagic disease virus 2 from Singapore 2020 outbreak revealed an Australian recombinant variant

Eileen Y Koh, Jasmine Ong, Yifan Wang, Xinyu Toh, Charlene Judith Fernandez, Taoqi Huangfu, Robyn N Hall, Steffie Tan, Kelvin Lim, Wendy Sng, Hwee Ping Lim, Kelvin Ho, Siew Foong Chang, Him Hon Yap

Author Notes

Published: 02 May 2023 Article history



Newcastle Disease in Layer Chickens

Lumpy Skin Disease in Dairy Cattle

2020 2021 2022 2023 2024

COVID-19

Canine Parvovirus at animal facilities

SARS-CoV-2 in Zoo Animals

EMERGING INFECTIOUS DISEASES

Anthropogenic Transmission of SARS-CoV-2 from Humans to Lions, Singapore, 2021


Mark Schipp @MarkSchipp

On Friday I was able to visit one of the two cattle farms in Singapore affected by the lumpy skin disease outbreak, where the infected cattle were largely recovered. @DeptAgNews

African Swine Fever in Wild Boars and Imported Pi

EMERGING INFECTIOUS DISEASES

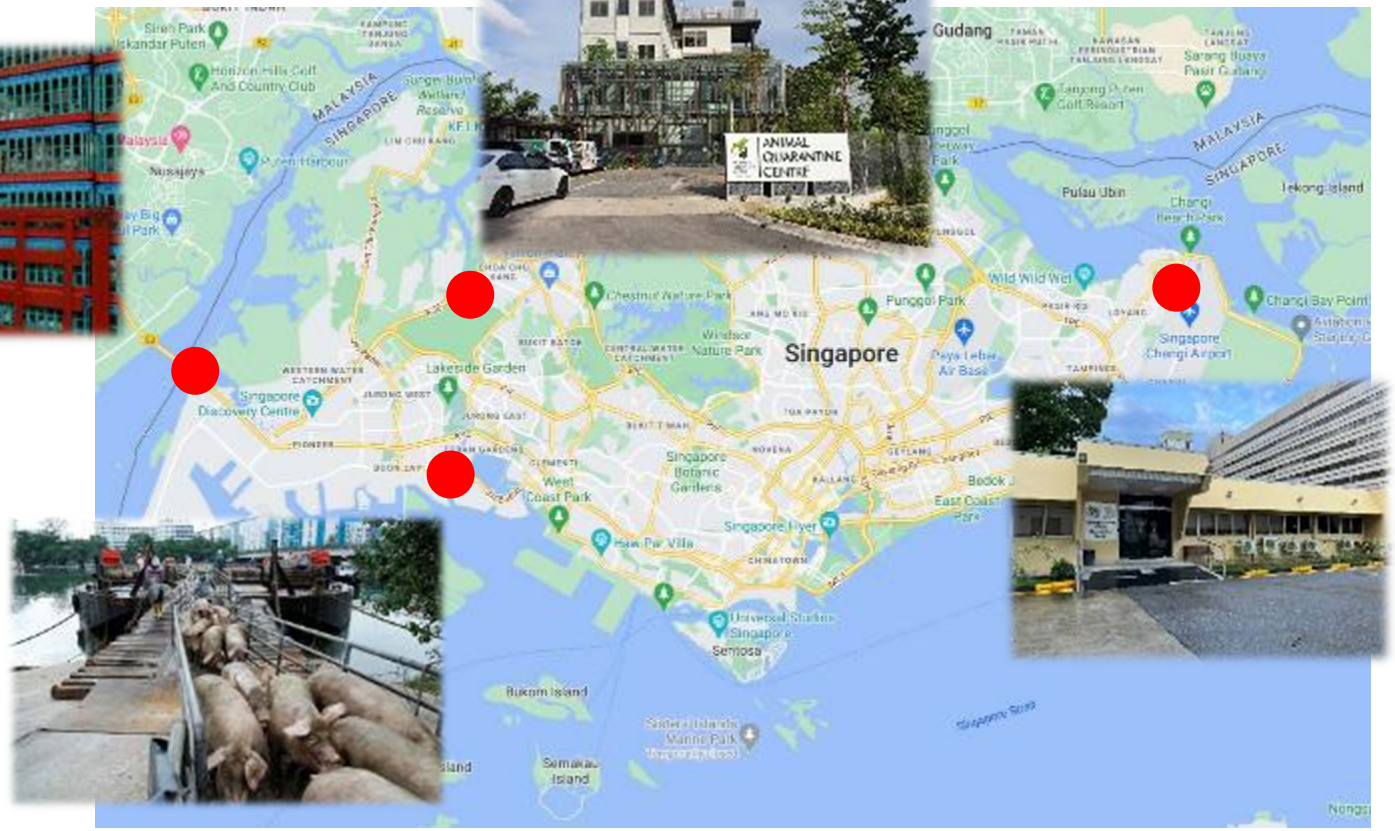
Detection of African Swine Fever Virus from Wild Boar, Singapore, 2023

Border Biosecurity

*Safeguarding **border biosecurity** during the import of **live animals and animal products** into Singapore through import inspection and quarantine*

Animal Quarantine Centre

Tuas Checkpoint



Changi Animal and Plant Quarantine @ Changi Airfreight Centre

Jurong Port and Buroh Lane Jetty

Animal Smuggling – Bypassing Import Measures

Man jailed for smuggling endangered birds into S'pore; many eventually died from cramped conditions

BY LOUISA TANG

Published December 8, 2021
Updated December 8, 2021

Singapore

IN FOCUS: How pet shops in Johor offer to smuggle animals into Singapore

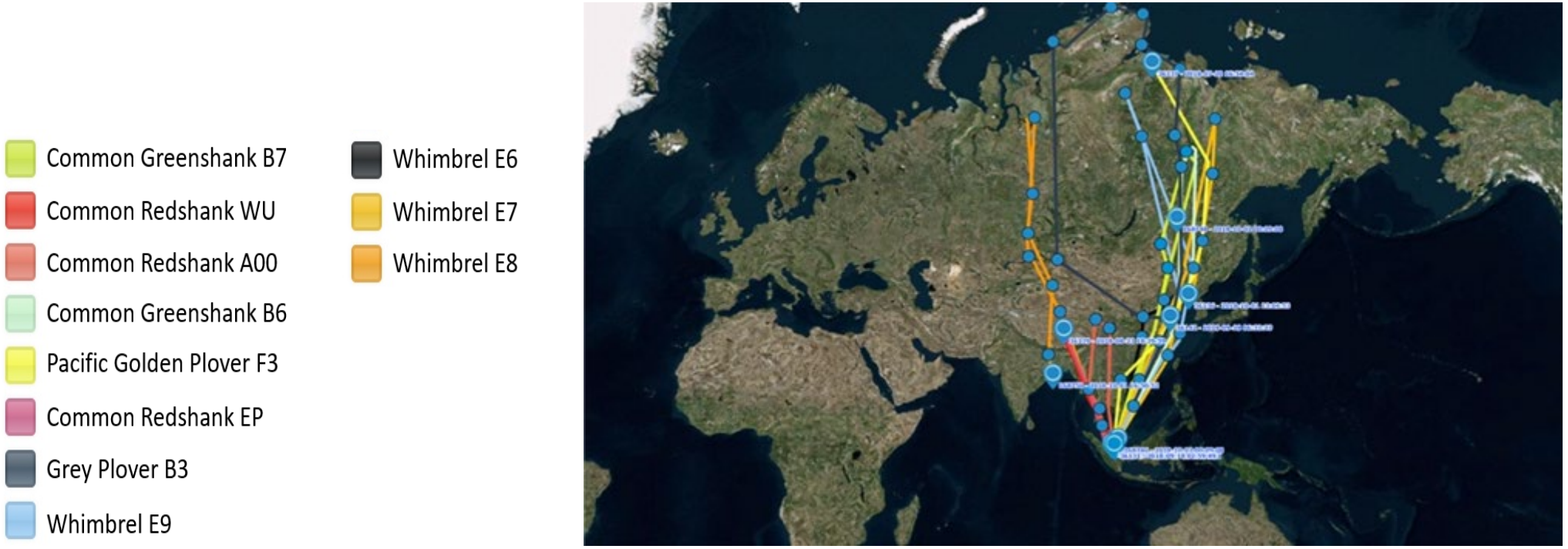
It's illegal and puts the welfare of animals at risk, but some sellers in Johor Bahru say they're willing to smuggle pets into Singapore.

THE STRAITS TIMES SINGAPORE LOG IN

Lorry driver who smuggled animals from Malaysia into S'pore gets jail; 19 dogs died

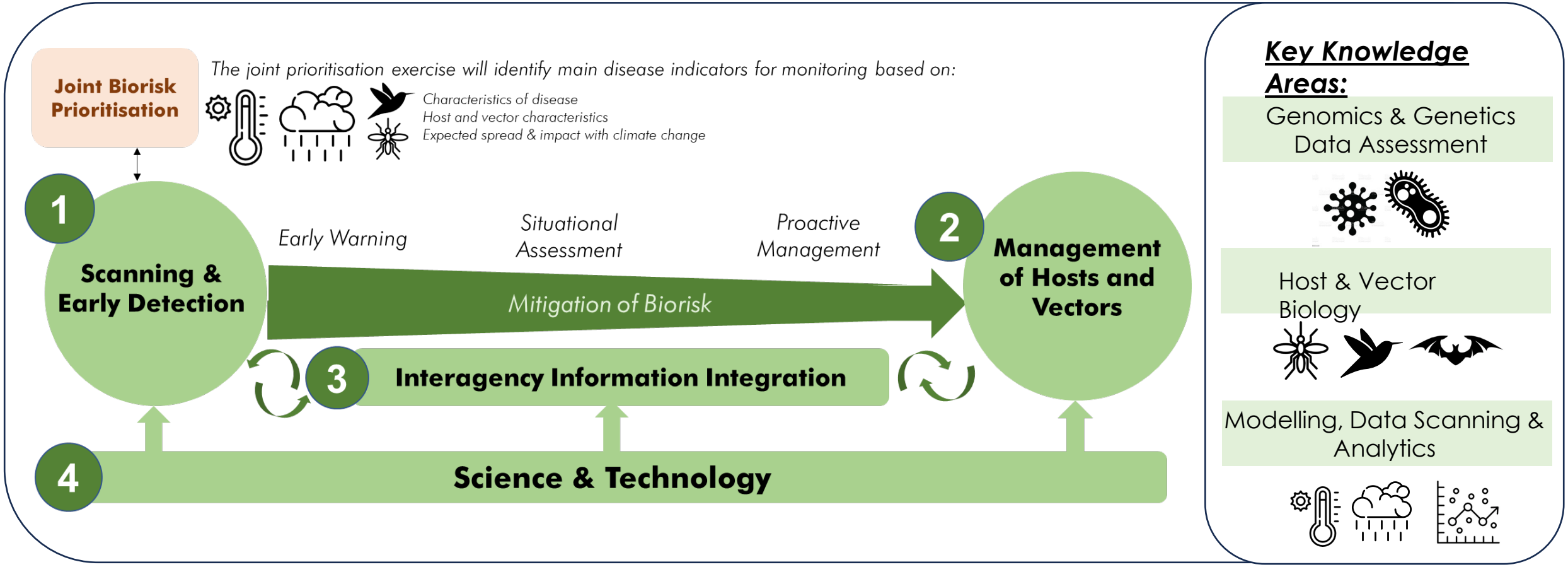
Satellite tracking of migratory birds

- Improving understanding of wild bird migratory flyways
- Inform avian influenza viral migration pathways and potential risks to Singapore
- Augment avian influenza biosurveillance programmes



Whole-of-Government (WOG) Biosurveillance

To monitor **upstream biorisks in the environment** & enhance Singapore's resilience to public health threats

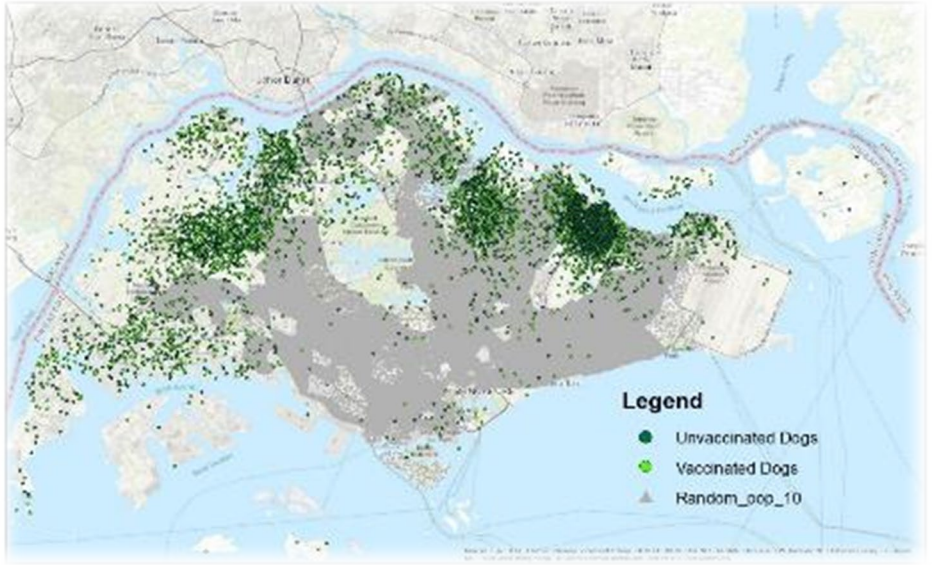


*Create an **early warning system** for animal health and zoonotic threats*

Biosurveillance – pathogens & vectors

- Biosurveillance for early pathogen detection: host (migratory birds), faeces/water/air surveillance
- Targetted and risk-based sampling (e.g. dead birds, migratory seasons)
- Enhanced vector surveillance e.g. ticks
- Research and understanding local tick fauna, biting midges and sandflies

Strengthen ***animal host and emerging vector monitoring, control and disease management***



Examples of Initiatives

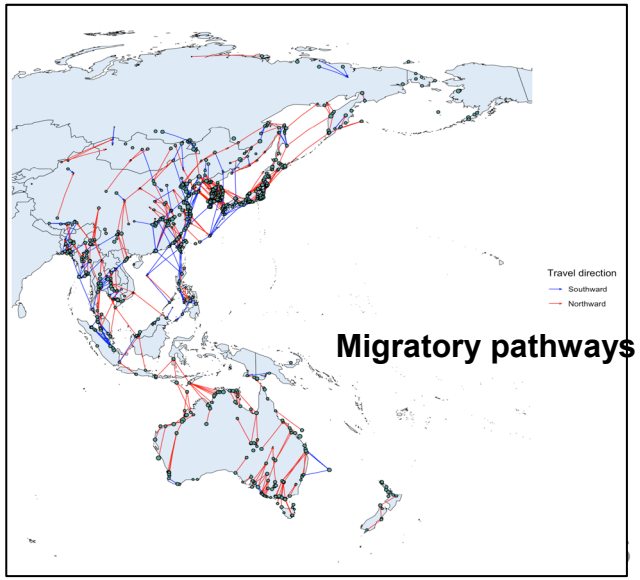
- Applied targeted field studies in animal hosts, insect vectors, and pathogens to enhance current understanding of disease transmission pathways
  - e.g. animal health and vector survey at animal establishments and quarantine sites
- Modeling of disease incursion, transmission and

Research Article

Modeling Singapore's First African Swine Fever Outbreak in Wild Boar Populations

Rayson Bock Hing Lim, Zhan Pei Heng, Kelvin Ho, Kane Koh, Hwee Ping Lim, Kelvin Lim, Wendy Sng, Gordon Tan, Ernest Teo, and Tze Hoong Chua

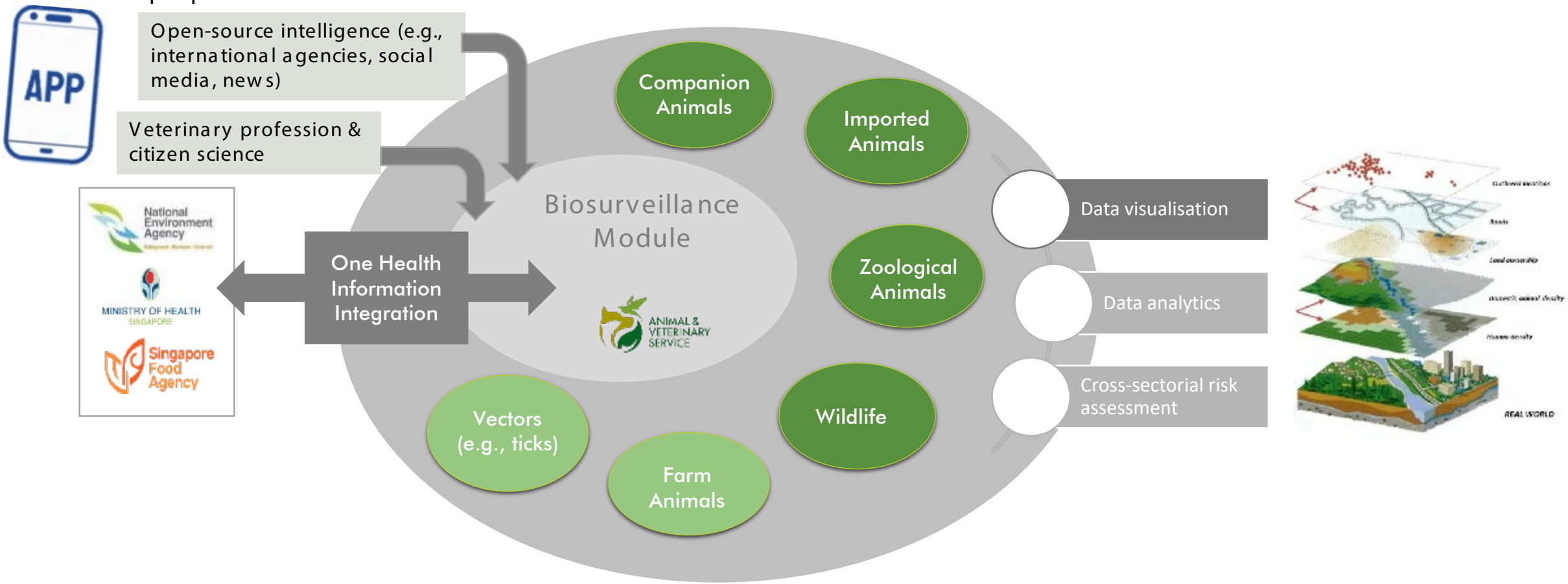
Veterinary Health Division, Animal and Veterinary Service, National Parks Board, Singapore, Singapore



Migratory pathways

Development of Animal Health Information System

To deliver innovative information solutions and enhance digital connectivity with key animal stakeholders for improved traceability and monitoring of animal diseases and zoonoses in local animal populations



Leveraging technology to strengthen border biosecurity

- Drones and CCTVs for remote inspections – an early warning system for detecting transboundary animal diseases like African Swine Fever.
- Smart IoT collars for home quarantine of dogs and cats
- CCTV / VA monitoring at quarantine centre

Animal Quarantine System

REGION : Asia and the Pacific

World Organisation for Animal Health

RABIES

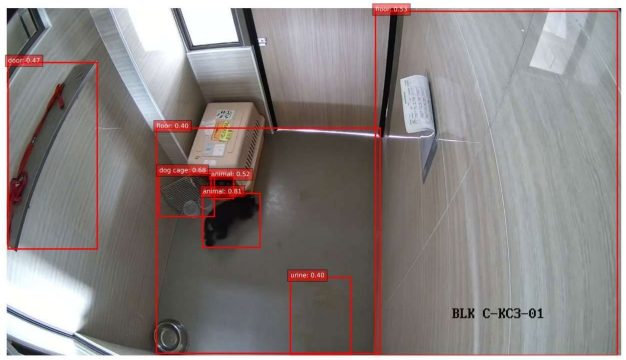
Preventing rabies and improving animal welfare thanks to technologies in Singapore

OCTOBER 19, 2023

Share on social media :

Singapore has implemented strict measures to maintain its rabies-free status. Dogs imported from lower rabies-risk countries are allowed to stay at the home of their owners during the quarantine. The Veterinary Services use radio frequency technology to monitor dogs, it has

AA rr-asia.woah.org



One Health collaboration

- One Health agencies for cross sectoral working relations to safeguard public health
  - Ministry of Health, National Environment Agency, National Parks Board, Singapore Food Agency and Singapore Water Agency
- Intelligence scans and joint risk assessments of emerging disease threats
- Zoonotic disease prioritization workshop to prioritise zoonotic diseases of greatest concern for Singapore for prevention and control.
- Vector Biosurveillance
- Disease investigation for leptospirosis
- Simulation exercises i.e. African Swine Fever, rabies and avian influenza.

https://www.moh.gov.sg/resources-statistics/reports/situational-and-risk-assessment-report-for-one-health-hazards

Disease Contingency and Preparedness

To develop and review disease contingency and preparedness plans. To conduct table-top exercises and drills with internal stakeholders and external partner agencies.

NParks-SFA tabletop exercise for Africa Swine Fever in 2021

NParks tabletop exercise for rabies in 2022

NParks-SFA exercises for HPAI in 2024

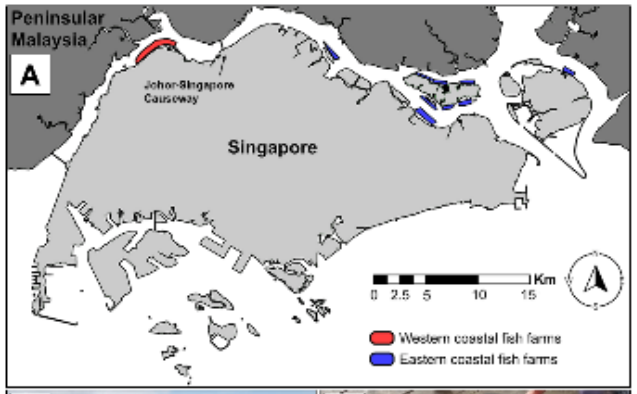
Animal Health Outreach Programmes

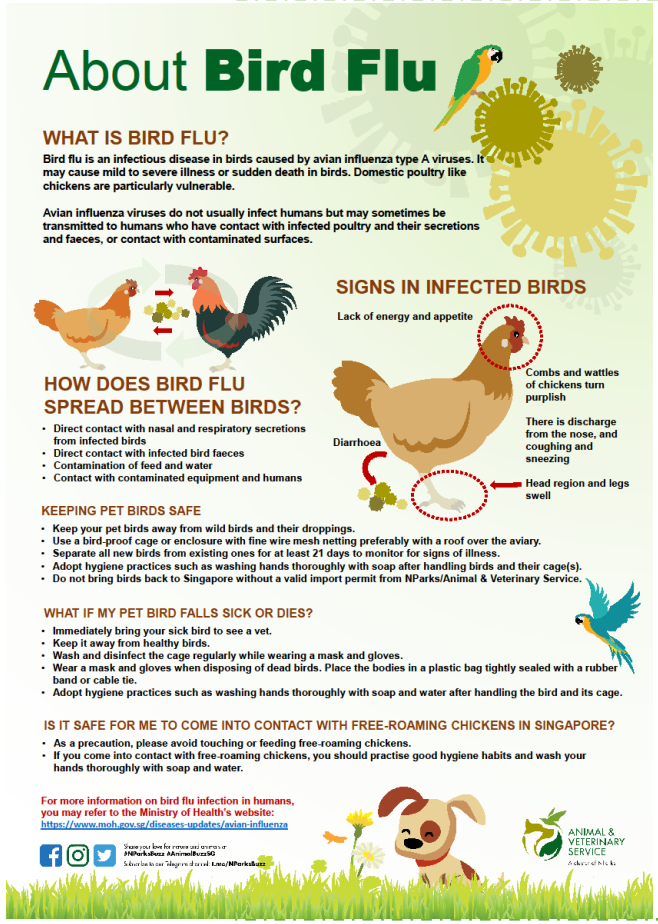
To safeguard animal health and biosecurity through community partnership and stewardship

An engagement and advocacy lesson for rabies prevention: Singapore's Trap-Neuter-Rehome/Release-Manage Programme (TNRM) and mass rabies vaccination

Kelvin Ho[1], Evan Lin[1], Anhui Lin[1], Kelvin Lim[1], Charlene J Fernandez[1], Pamela Lim[1], Hwee Ping Lim[1], Hui Ling Lin[1], Wai Kwan Wong[1], Boon Han Teo, Xinyu Toh, Yifan Wang, Taoqi Huangfu, Tze Hoong Chua[1], Siow Foong Chang[1], Jessica Kwok[1], Him Hoo Yap[1]

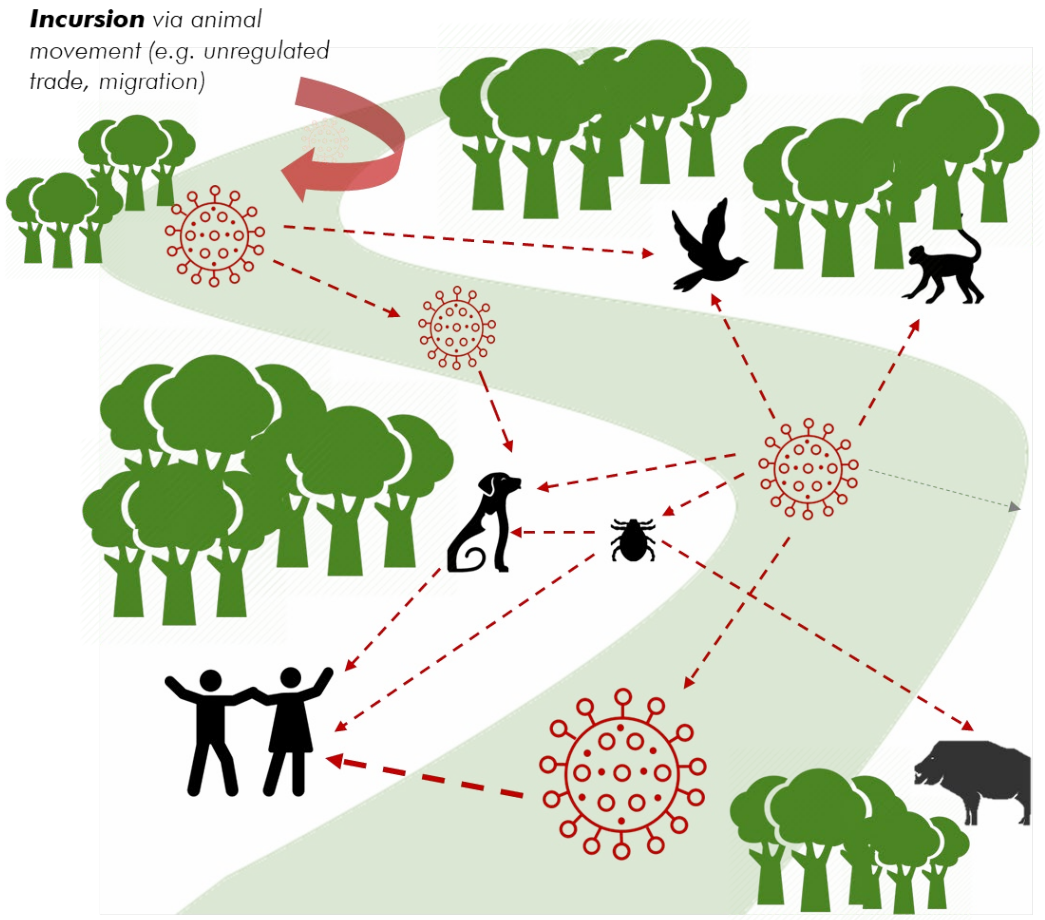
[1]Animal & Veterinary Service (AVS), National Parks Board





Biosurveillance Research

The biosurveillance research funding initiative seeks to foster **transdisciplinary research collaboration through an One Health framework**, by studying key drivers of zoonoses at the **animal-human-environment interface** in two thematic knowledge areas:



Genomics and Genetics

- **Genome as the critical link among pathogens, hosts and vectors**
- Generate insights into microbiome, genomic & genetic effects on diseases in animal hosts together with enhanced **invertebrate vector (iDNA)** and **environmental sampling (eDNA)** for animal pathogen detection and characterisation

Ecological & Epidemiological Connectivity

- **Going beyond pathogen discovery to linking pathogens to the wider urban ecosystem**
- Clarify **ecological and epidemiological linkages** between animal hosts, vectors, environment and humans, and **environmental and anthropogenic* influences** on zoonoses

supports

**Anthropogenic influences include socio-behavioural drivers of animal movement, including unregulated trade of pets and wildlife*

Develop and examine evidence-based **upstream mitigation strategies** for zoonoses

Thank you

Email: chua_tze_hoong@nparks.gov.sg

HPAI vaccination in Local Birds

- No H5 vaccination in farms and other avian establishments during peacetime
  - Biosecurity and regular biosurveillance remain the key measures
  - However, H9 vaccination allowed in poultry farms as part of production disease control

- Limited risk-based H5 vaccination for high-risk species (Galliformes and Anseriformes) kept in open exhibits
  - E.g., swans in the Singapore Botanic Gardens, peafowls at Sentosa

- H5 vaccines are stockpiled for emergency vaccination of local poultry farms if the threat of HPAI is imminent:
  - Facilitates more rapid elimination of the virus from the environment and increases the chance of breaking the infection cycle should there be an incursion

- AI vaccines are periodically reviewed for their effectiveness against H5

HPAI vaccination for poultry farms – ongoing review

- Periodic review of H5 vaccination policy for local bird populations during peacetime and emergency
  - Changing HPAI risk with new emerging strains
  - Shifts in global attitudes towards vaccination
  - Biosecurity and culling alone may not be sufficient for the control of HPAI

- Principal considerations:
  - Impact of vaccination policy
    - Trade of poultry and poultry products
    - Food safety
    - Conservation of highly endangered species
  - Operationalisation feasibility
    - Industry acceptance e.g., cost-benefit
    - Availability of effective vaccines against predominant strains
    - Biosurveillance strategies to detect HPAI in vaccinated populations, including laboratory capabilities for DIVA


Source: SFA

HPAI vaccination for imported poultry and poultry products

- **Use of live or live-attenuated HPAI vaccines prohibited** in all imported poultry and poultry products

- **Use of other kinds of HPAI vaccines permitted for the following import situations**:
  - HPAI vaccines approved by exporting CA
  - Poultry products derived from HPAI-vaccinated poultry
  - Day-old chicks exported to Singapore or from HPAI-vaccinated breeders
  - Live broilers exported to Singapore, subject to exporting farm meeting key pre-export requirements, incl. routine biosurveillance and tests, WOAH standards


Source: Todayonline

- **Import of ornamental birds vaccinated against HPAI not allowed** due to limited information about HPAI vaccines suitable for non-poultry avian species


Source: SFA

- **Temporary import restriction of poultry & poultry products for HPAI-infected premises** with our regionalisation arrangements between exporting countries and Singapore.