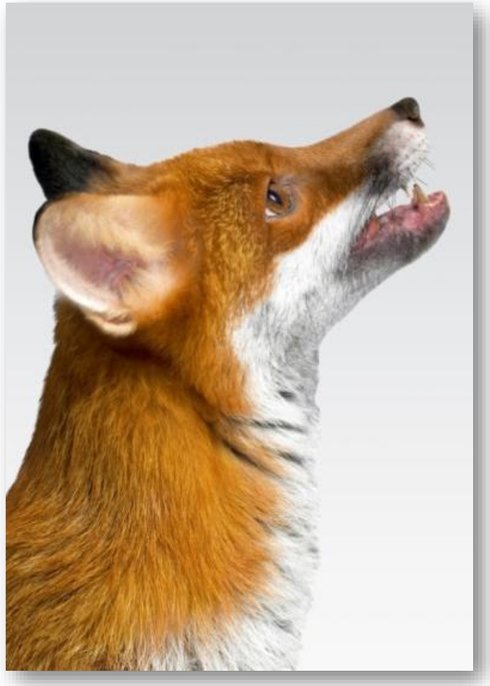
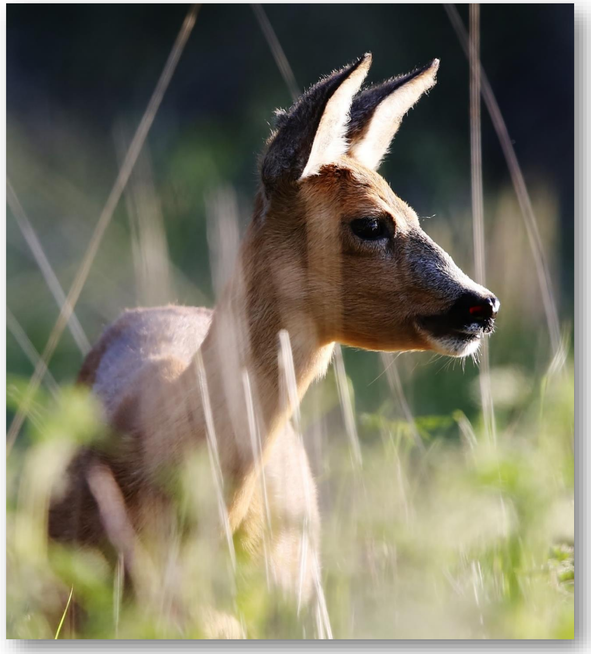
Principles for successful wildlife health surveillance

Dolores Gavier-Widén, WOAH working group on wildlife, Swedish Veterinary Agency



Workshop for the National Focal Points of Wildlife. Europe and Central Asia

25 – 26 June 2025, Tbilisi, Georgia

World Organisation for Animal Health
Founded as OIE

Organisation mondiale de la santé animale
Fondée en tant qu'OIE

Organización Mundial de Sanidad Animal
Fundada como OIE


Ecological balance

Healthy ecosystems-healthy wildlife-healthy people

- Wildlife provide ecosystem services - Contribute to human well-being, survival and quality of life

- The value of wildlife: social, cultural, economic, ecologic values

Game meat: ecological, climate friendly, renewable resource

https://www.natureza-portugal.org

Wildlife a victim of:

- Disease emergence
- Misinformation, wrong perceptions
- Depopulation, culling
- Habitat loss, climate change
- Trafficking, alien species
- Poor wildlife management
- Human activities

Pelican, oil spill

https://leesbird.com/2010/06/22/louisiana-oh-louisiana

Red squirrel *(Sciurus vulgaris*), pox virus

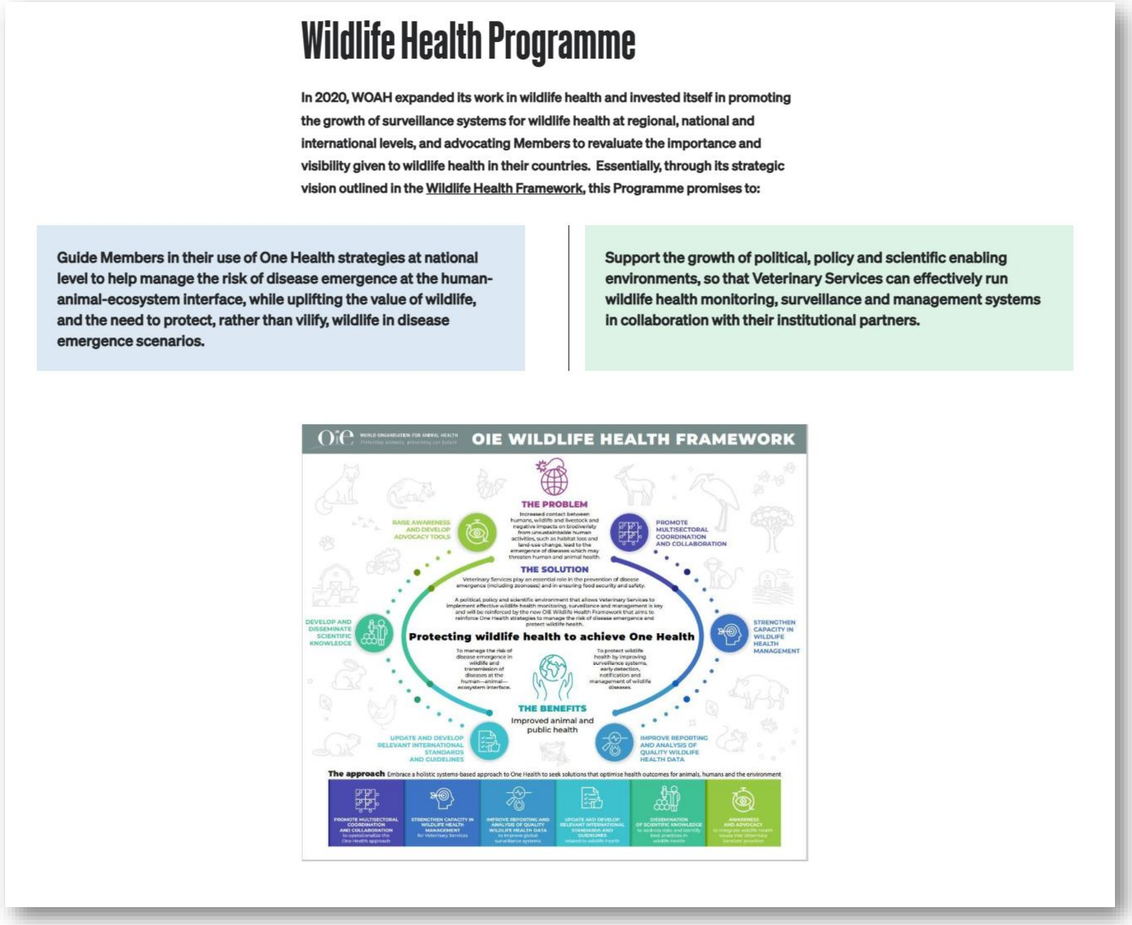
https://westmorlandredsquirrels.org.uk/squirrels/threats-to-reds/

Stone marten (Martes foina) *culled in southern Sweden. The bright white throat patch and visible paw pads distinguishes it from the pine marten* (Martes martes). *Photo: Invasive species task force.*

Stone marten (*Martes foina*), invasive species

WOAH Wildlife Health Programme: protecting wildlife health to achieve One Health

- Global project, 2020
- Response to global trends in disease emergence and biodiversity loss
- Aligned with the One Health approach and WOAH's 7th Strategic Plan
- Implements WOAHs Wildlife Health Framework
- Promotes the growth of surveillance systems for wildlife
- Central role of National Veterinary Services (NVS) in early detection, surveillance, and management of wildlife diseases



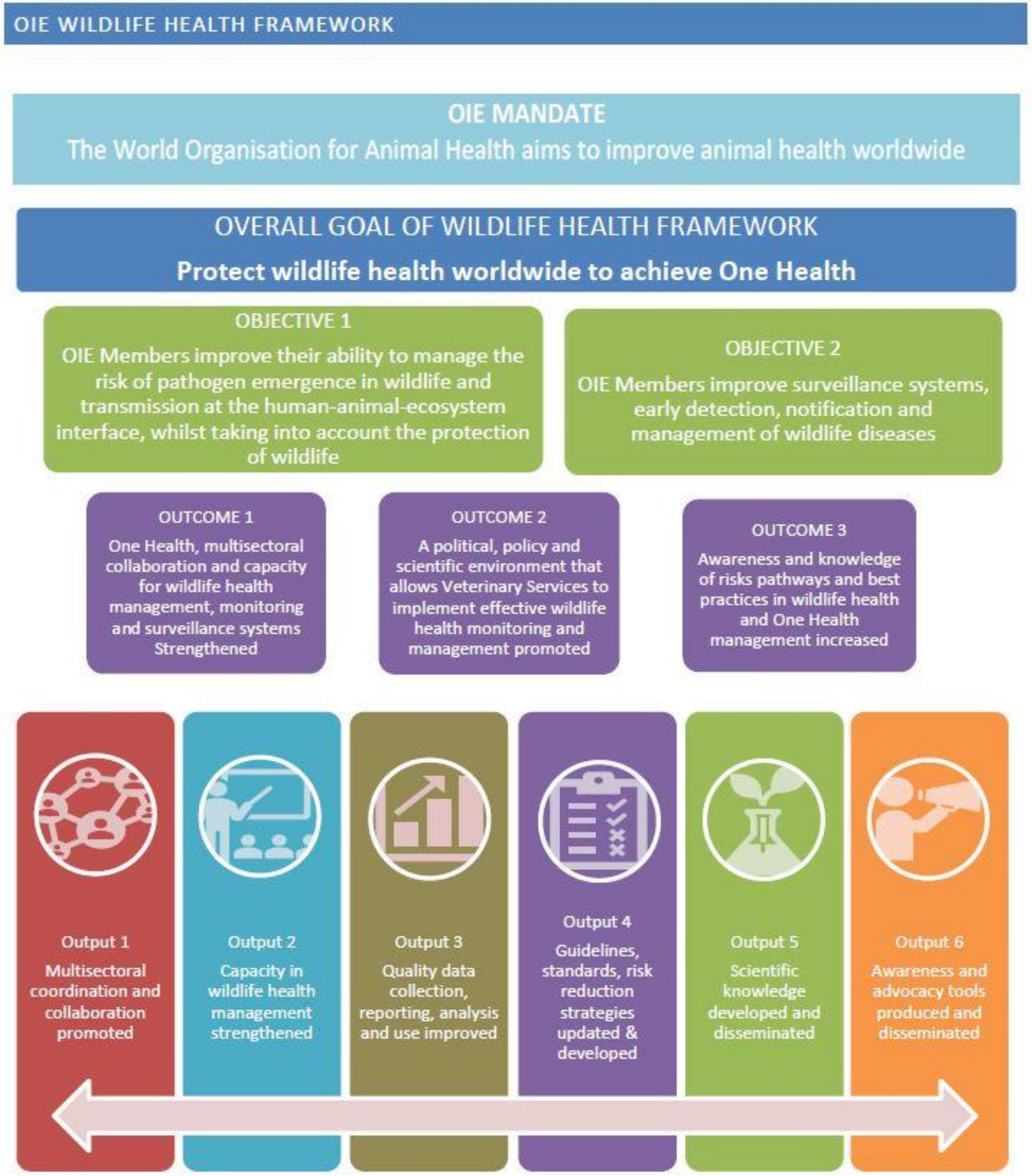
Wildlife Health Programme

In 2020, WOAH expanded its work in wildlife health and invested itself in promoting the growth of surveillance systems for wildlife health at regional, national and international levels, and advocating Members to revaluate the importance and visibility given to wildlife health in their countries. Essentially, through its strategic vision outlined in the Wildlife Health Framework, this Programme promises to:

Guide Members in their use of One Health strategies at national level to help manage the risk of disease emergence at the human-animal-ecosystem interface, while uplifting the value of wildlife, and the need to protect, rather than vilify, wildlife in disease emergence scenarios.

Support the growth of political, policy and scientific enabling environments, so that Veterinary Services can effectively run wildlife health monitoring, surveillance and management systems in collaboration with their institutional partners.

Wildlife Health - WOAH - World Organisation for Animal Health



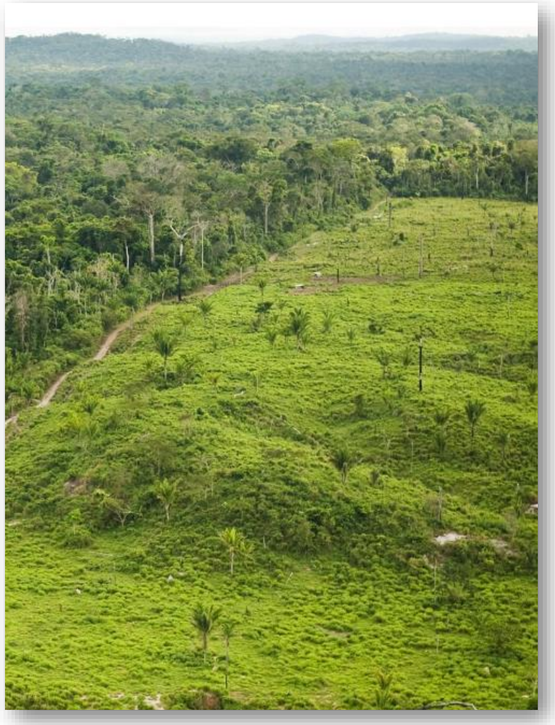
The WOAH (OIE) Wildlife Health Framework

Supports WOAH Members in improving:

- ability to reduce, anticipate and manage the risk of pathogen emergence and transmission at the human-animal-ecosystem interface;
- early detection, notification and management of wildlife diseases.

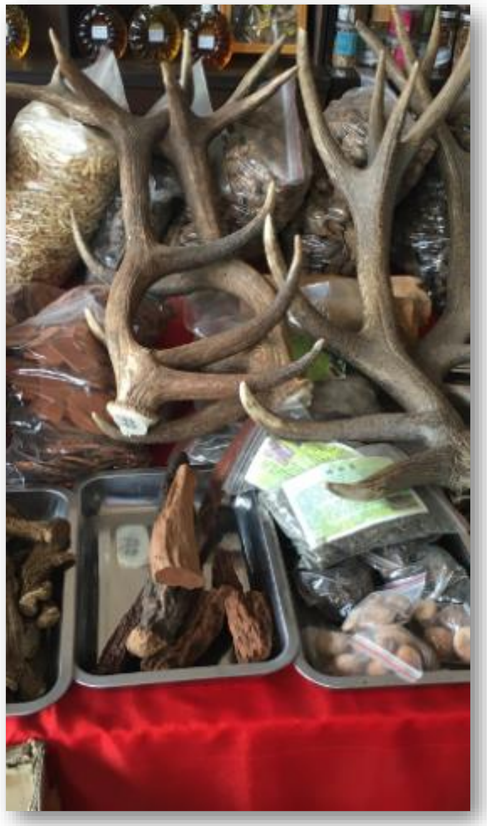
Ensuring that wildlife health is adequately monitored and managed with the same diligence as domestic animal health is vital for taking a One Health management approach by Veterinary Services

Europe and Central Asia: complex wildlife health challenges



Reduction of natural habitats

Habitat loss, fragmentation, increased livestock production



https://www.ecohealthalliance.org/2018/02/heres-how-wildlife-trade-and-disease-spread-are-linked

Wildlife trade

EU Action Plan against Wildlife Trafficking 2016.

Rewilding, translocations, etc

Grey wolf (*Canis lupus*)

Human-wildlife conflicts

Large carnivores recovering populations, urban wildlife, etc

Intermediate horseshoe bat (*Rhinolophus affinis*)

Zoonotic diseases in wildlife

Human perception wrongly implicating wildlife as dangerous

WOAHs response to wildlife health challenges

WOAH regionalised approach

1. Wildlife Health Network for Europe and Central Asia
Across 53 countries, since 2023
Supports National Focal Points for Wildlife (NFPWs) through knowledge-sharing, webinars, and strengthened cooperation

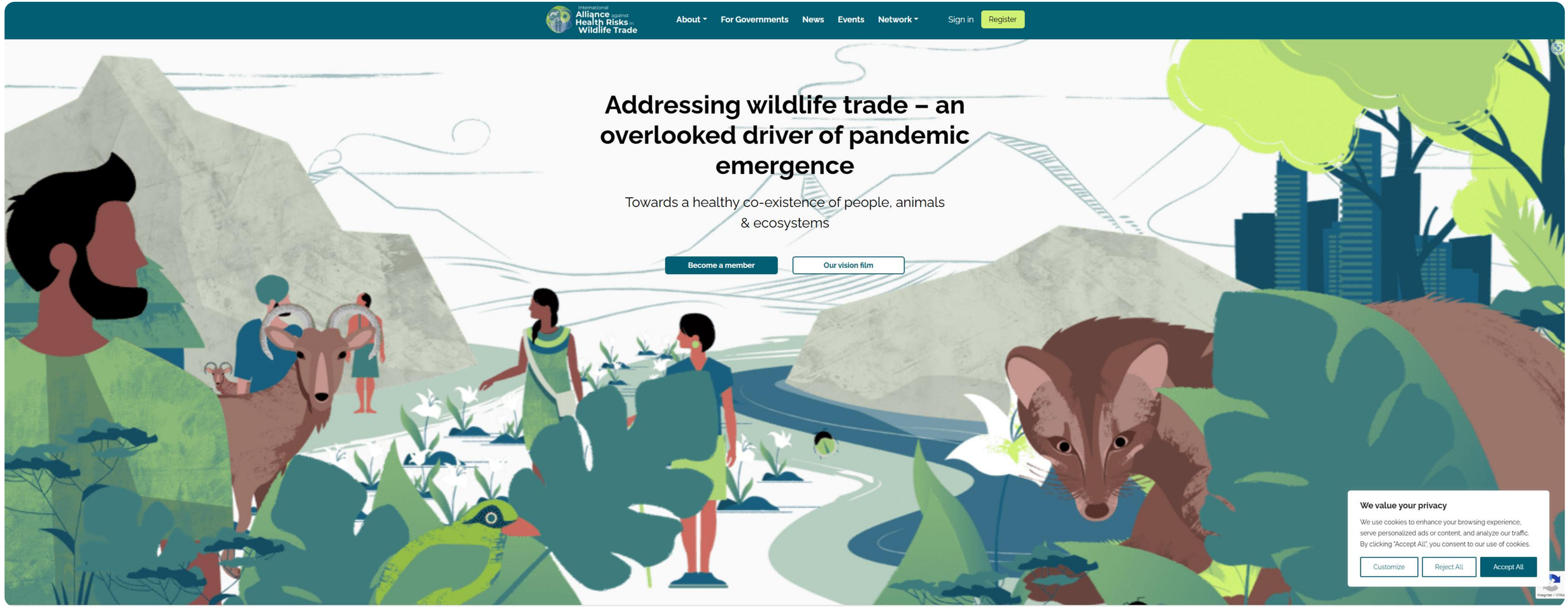
2. Wildlife Health Implementation Plan (2-years plan)
adaptation of the WOAH Global Wildlife Health Framework to the needs of the NFPWs in the region.

International Alliance against Health Risks in Wildlife Trade

WOAH becomes the new secretariat

SWEDISH VETERINARY AGENCY

>400 international members



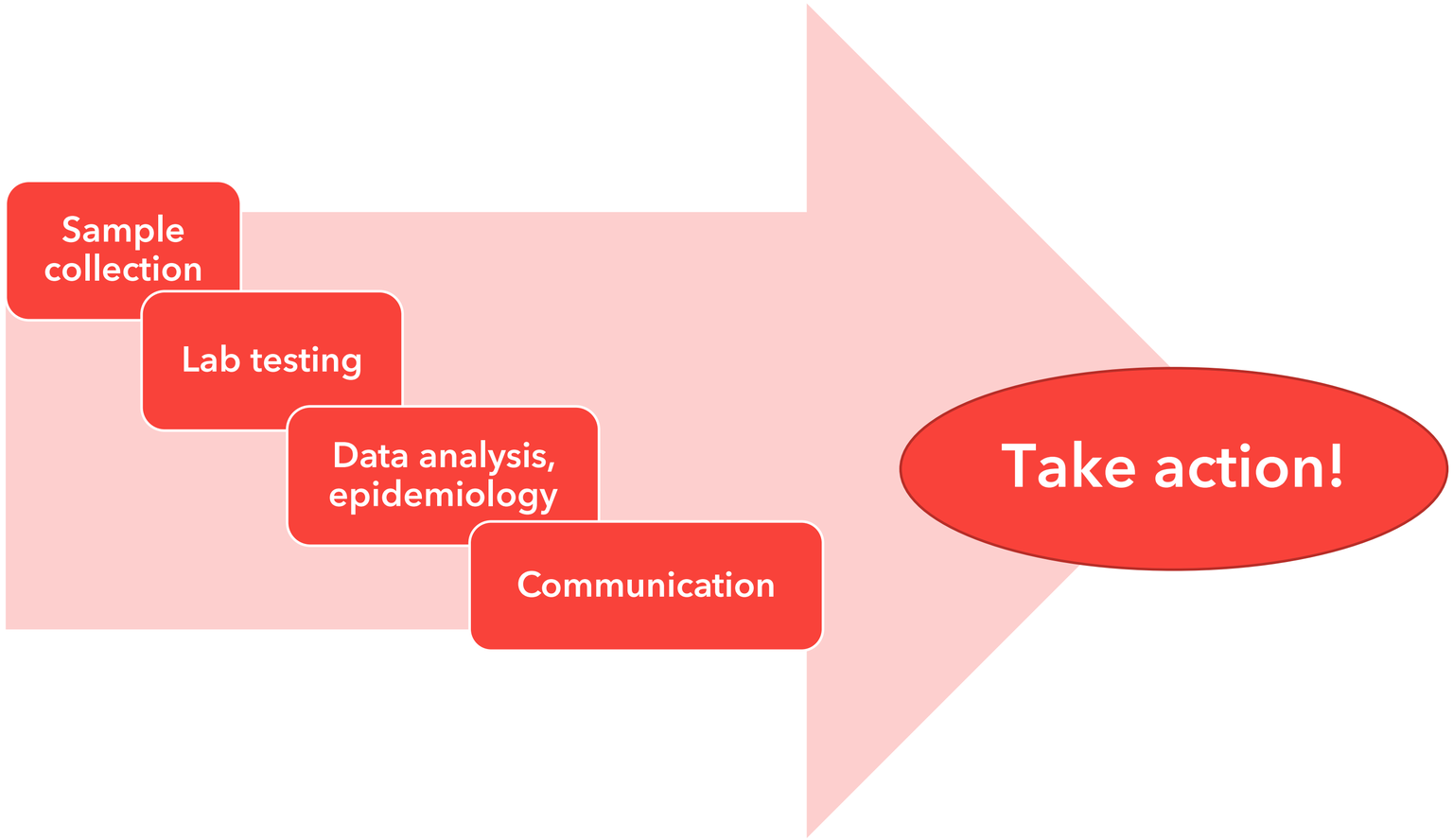
World Organisation for Animal Health
Founded in 1924

Wildlife Health/Disease Surveillance (WDS)

"Systematic ongoing collection and analysis of information related to wildlife health and timely dissemination of information so that action can be taken" (WHO-WOAH)

WDS: the basis of a nation's wildlife health program

Wildlife Disease Surveillance (WDS)



Types of Wildlife Health/Disease Surveillance (WDS)

General surveillance (passive or scanning): pathological examination of animals found dead or moribund. Capable of detecting any disease or pathogen

Targeted surveillance (active): testing animals for the presence of a specific disease/pathogen

Active and passive surveillance are complementary

Other forms of pathogen disease surveillance

- Event-based surveillance
- Sentinel surveillance
- Syndromic surveillance
- Participatory surveillance
- Integrated surveillance
- Risk-based surveillance
- Other forms of surveillance

General Guidelines for Surveillance of Diseases, Pathogens and Toxic Agents in Free-ranging Wildlife

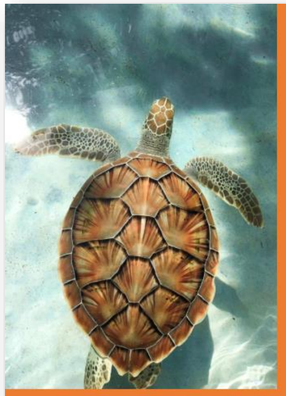
An overview for wildlife authorities and others working with wildlife

First edition

© Vyacheslav Argenberg

World Organisation for Animal Health

IUCN



TRAINING MANUAL ON WILDLIFE HEALTH INFORMATION MANAGEMENT

Sixth Cycle

Workshop for WOAH National Focal Points for Wildlife

World Organisation for Animal Health
Founded as OIE

Key steps when designing a surveillance programme

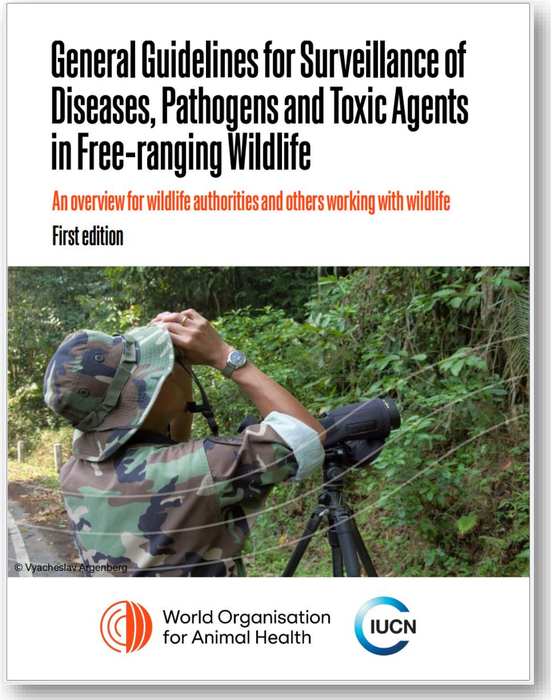


Figure 3. Steps to consider in the design of surveillance programmes.

Coordinating a general surveillance program for wildlife pathogens

Challenges

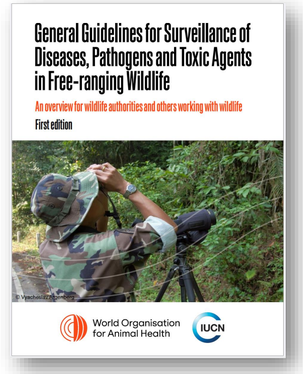
- Different components
- Many participants: veterinary services, public health, wildlife biologists and ecologists, NGOs, universities, others
- Shared responsibility: branches of government including wildlife, environment, public health, agriculture, veterinary services, tourism, economics, border services and international relations
- WOAH focal point for wildlife can play a key role in assuring and facilitating effective coordination.

Objectives of surveillance should be clearly defined and communicated…from the beginning

Box 4. Potential uses of surveillance information

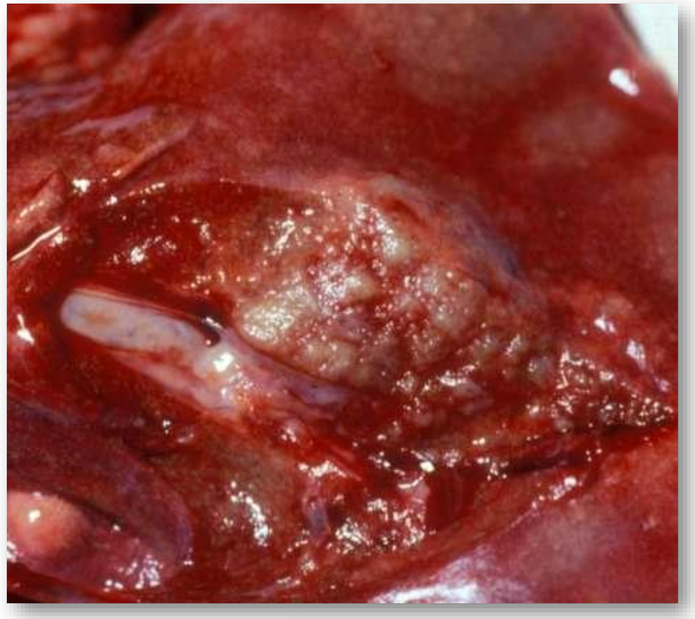
Depending on the scope and objectives, information collected from surveillance may:

- provide a baseline understanding and allow for detection of changes;
- detect immediate or potential threats and impacts, including emerging diseases;
- support species conservation assessments and the development of action plans;
- evaluate the effectiveness of disease management and risk reduction initiatives and guide refinements as needed;
- demonstrate the absence of a disease or pathogen;
- inform risk and impact assessments for human, animal and environmental health.



Objectives of general (passive) wildlife disease surveillance

- Early detection
- Higher chance of detecting positive animals than in targeted surveillance
- Correct sampling
- Diagnose and characterise diseases
- Interpretation of lab analyses: cause of disease? Cause of mortality?
- Emerging diseases



Bovine tuberculosis, lung, E. badger (*Meles meles*)

Sarcoptic mange, red fox (*Vulpes vulpes*)

Objectives of targeted (active) wildlife disease surveillance

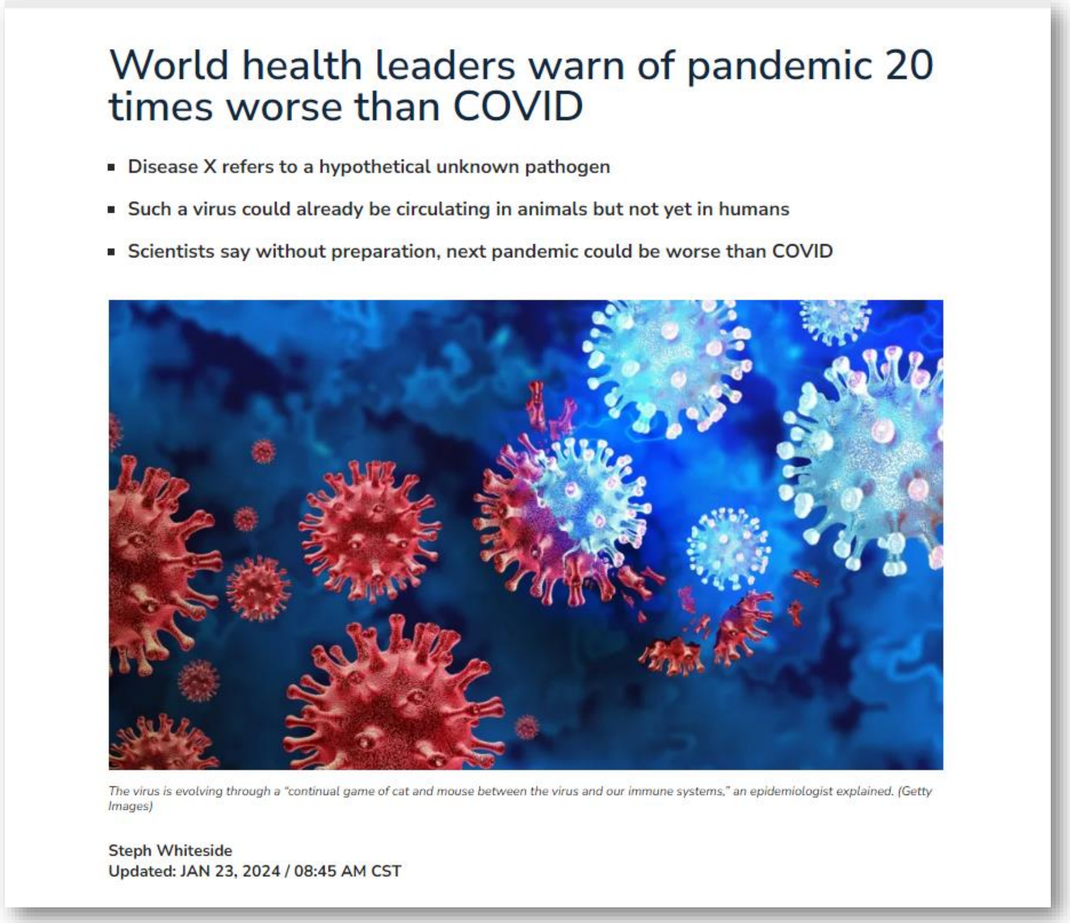
- Freedom from disease/pathogen
- Identify and monitor trends/patterns in the distribution and occurrence of the pathogen
- Prevalence
- Incidence
- Data for risk analysis
- Support control
- Risk management, monitor implemented measures

Passive wildlife disease surveillance

European brown hare (*Lepus europaeus*)

SWEDISH VETERINARY AGENCY

Disease X (unknown pathogen, "next pandemic")



World health leaders warn of pandemic 20 times worse than COVID

- Disease X refers to a hypothetical unknown pathogen
- Such a virus could already be circulating in animals but not yet in humans
- Scientists say without preparation, next pandemic could be worse than COVID

The virus is evolving through a "continual game of cat and mouse between the virus and our immune systems," an epidemiologist explained. (Getty Images)

Steph Whiteside
Updated: JAN 23, 2024 / 08:45 AM CST

Most likely a:

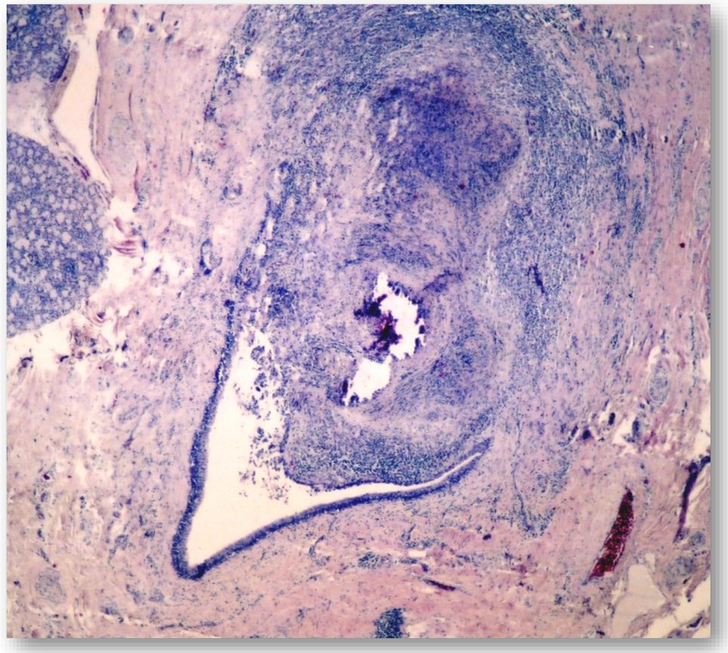
- Zoonotic, multi-host, widely distributed
- RNA virus
- Respiratory virus
- Emerging from high risk area
- Possibly already circulating in animals and has not yet made the jump to humans.

Passive surveillance important to detect X, or Y…or new emerging diseases/pathogens in wildlife. Pathology is needed to characterise the disease.

/www.newsnationnow.com/health/world-health-leaders-warn-pandemic-worse-covid/

Pathology informs epidemiology

- Route of infection
- Route of shedding/excretion
- Levels/amounts and patterns of shedding
- Acute, chronic, latent forms
- Host species-susceptibility
- Impact on health of animal populations



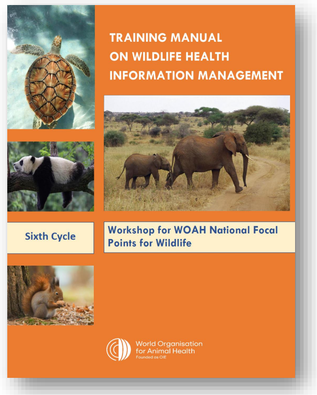
Tuberculous granuloma opening into lumen of salivary duct, wild boar=shedding of *Mycobacterium bovis*

General Surveillance Program for Wildlife Pathogens

5 components:

1. Detection of pathogens and diseases
2. Identification of pathogens and diseases
3. Information management
4. Analysis and communication
5. Taking action

- The backbone of any efforts to understand and manage what pathogens (and diseases) exist in a nation's wildlife population
- An essential tool for detecting and responding to novel emerging diseases associated with wild animal pathogens



1. Detection of pathogens and diseases

First step: Observations of ill or dead animals in the field/in nature

-General public, citizen scientists, local communities, Indigenous People

-Ornithologists, hunters

-Park guardians, rangers

-Detection networks (field observers): marine mammals, coastal network

-Conservation organisations

-Wildlife rehabilitators

Needs: involvement of volunteers, capacity building, awareness raising

Fox (*Vulpes vulpes*) cub found dead, **HPAI.** Photo: Joao Yazlle

1. Detection of pathogens and diseases

Second step: reporting of ill or dead animals in the field/in nature

Phone apps

Web-based reporting

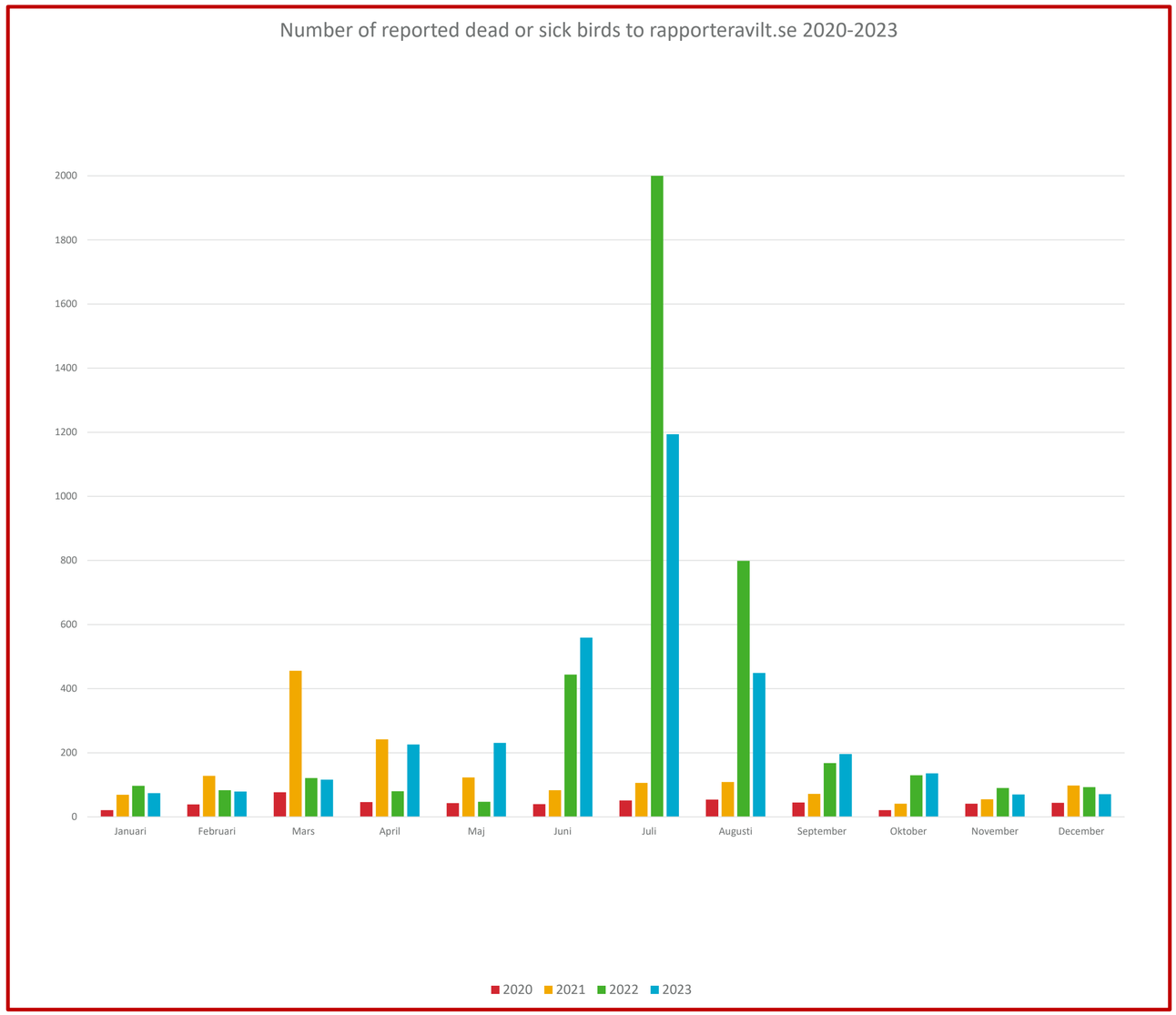
Social media

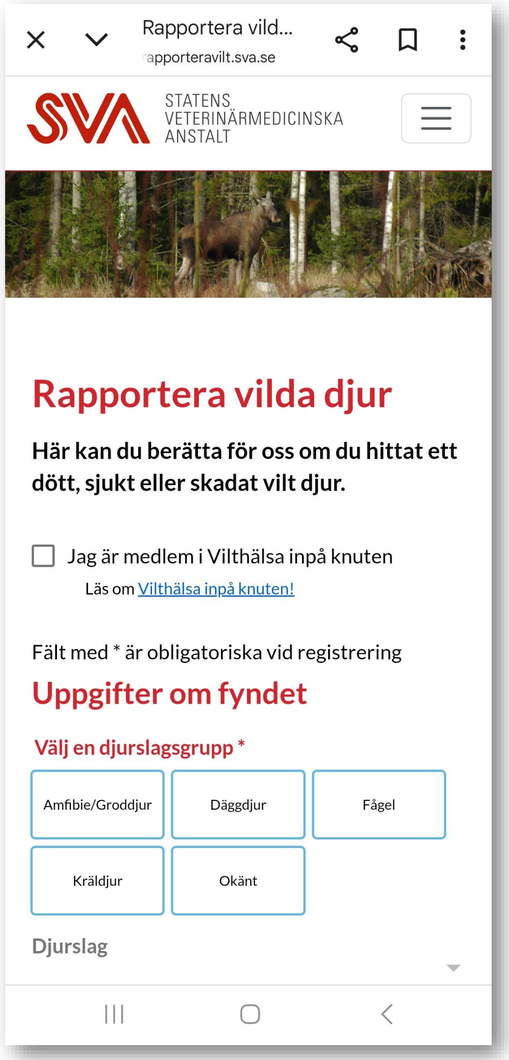
Telephone

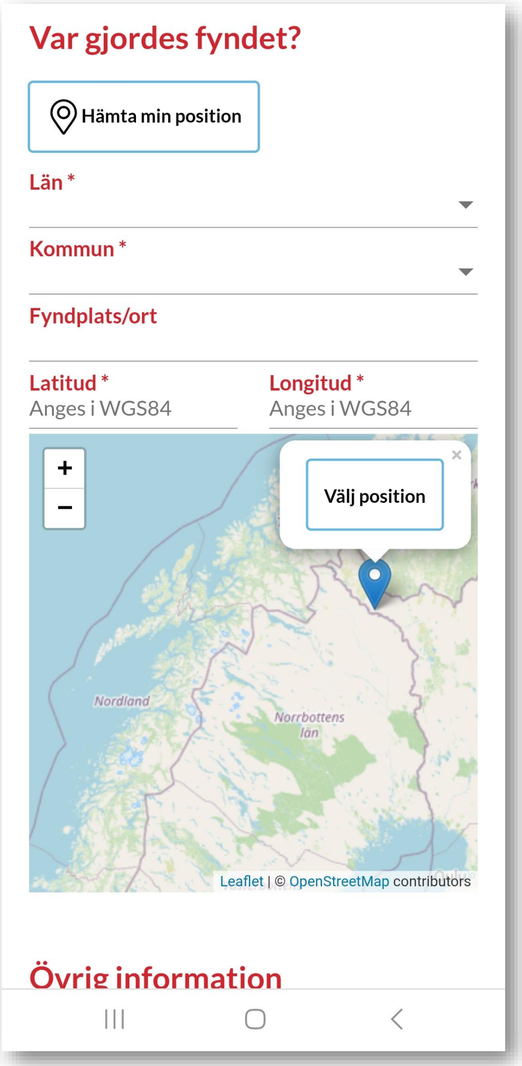
Paper-pencils, letters

Other…

Citizen science (detection, early warning, reporting, clinical data, sampling)







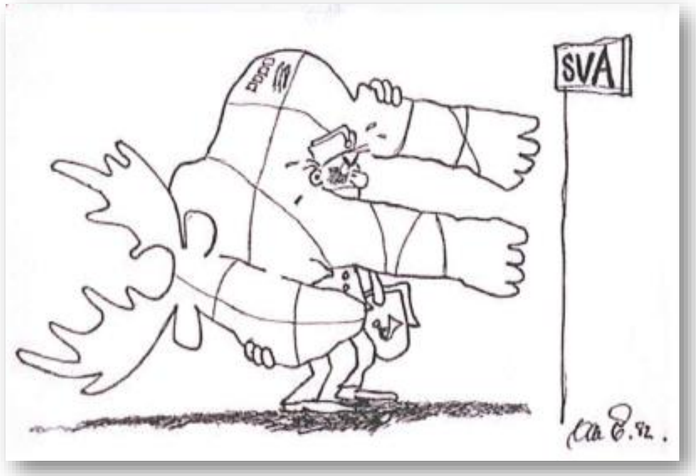
rapporteravilt.sva.se

1. Detection of pathogens and diseases

Third step: submission of ill or dead animals to the laboratories, or field necropsy and sampling

-Safe collection, handling and transport of carcasses or samples (WOAH Training Manual 6th cycle)

Sampling kit and personal protective equipment (PPE)



2. Identification of pathogens and diseases

- Identification of the species (may need help from biologists, genetic methods), give the scientific name! (for ex. *Vulpes vulpes*)
- Pathology needed to identify disease
- Post-mortem (necropsy), followed up by histopathology if needed

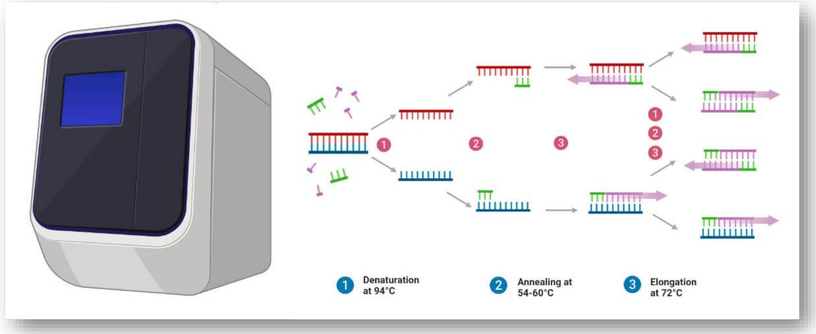
Field necropsy, killer whale (*Orcinus orca*)

Field sampling of wild boar (*Sus scrofa*)

2. Identification of pathogens and diseases

Laboratory diagnosis

- ✓ Virology
- ✓ Bacteriology
- ✓ Parasitology
- ✓ Molecular methods (PCR, others)
- ✓ Toxicology
- ✓ Immunohistochemistry



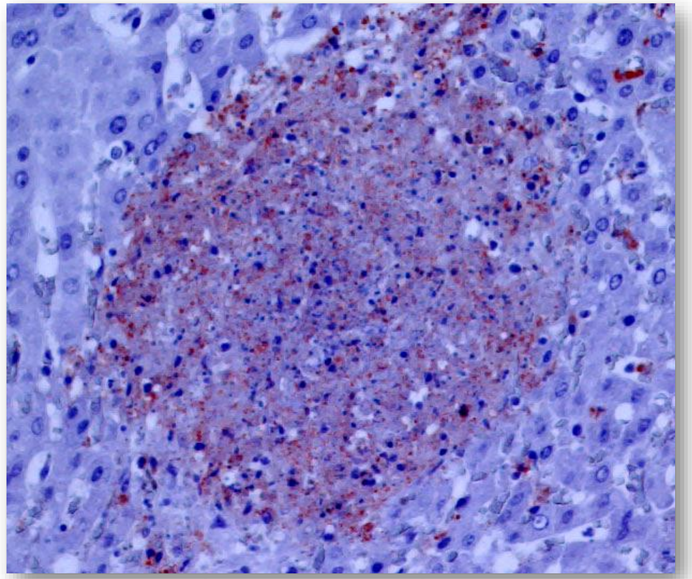
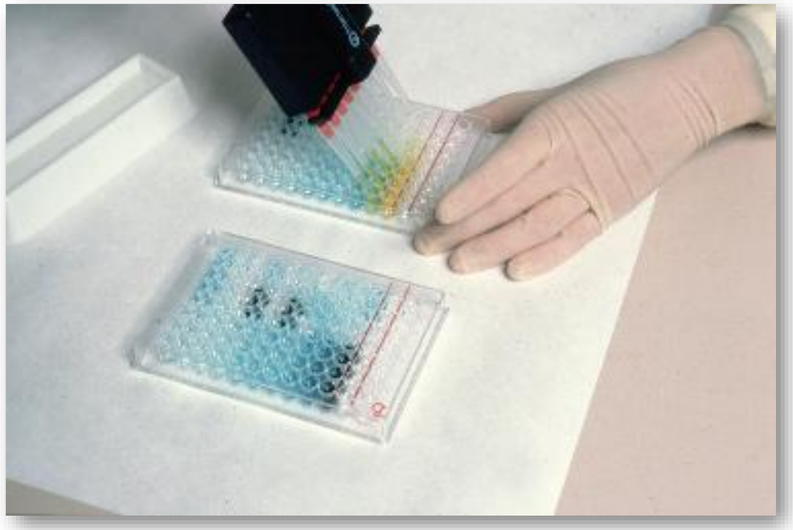
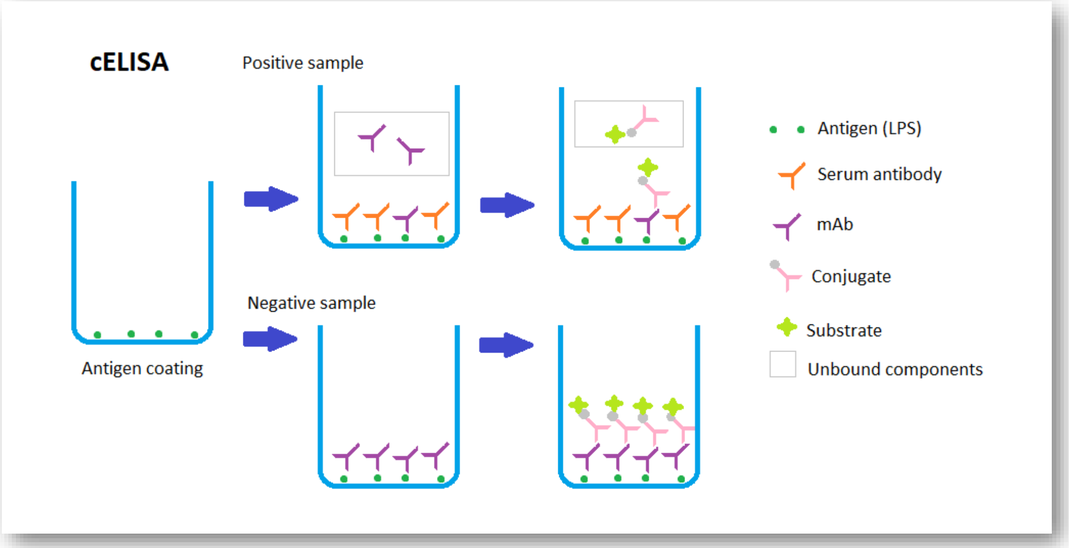


Photo: Gete Hestvik, SVA

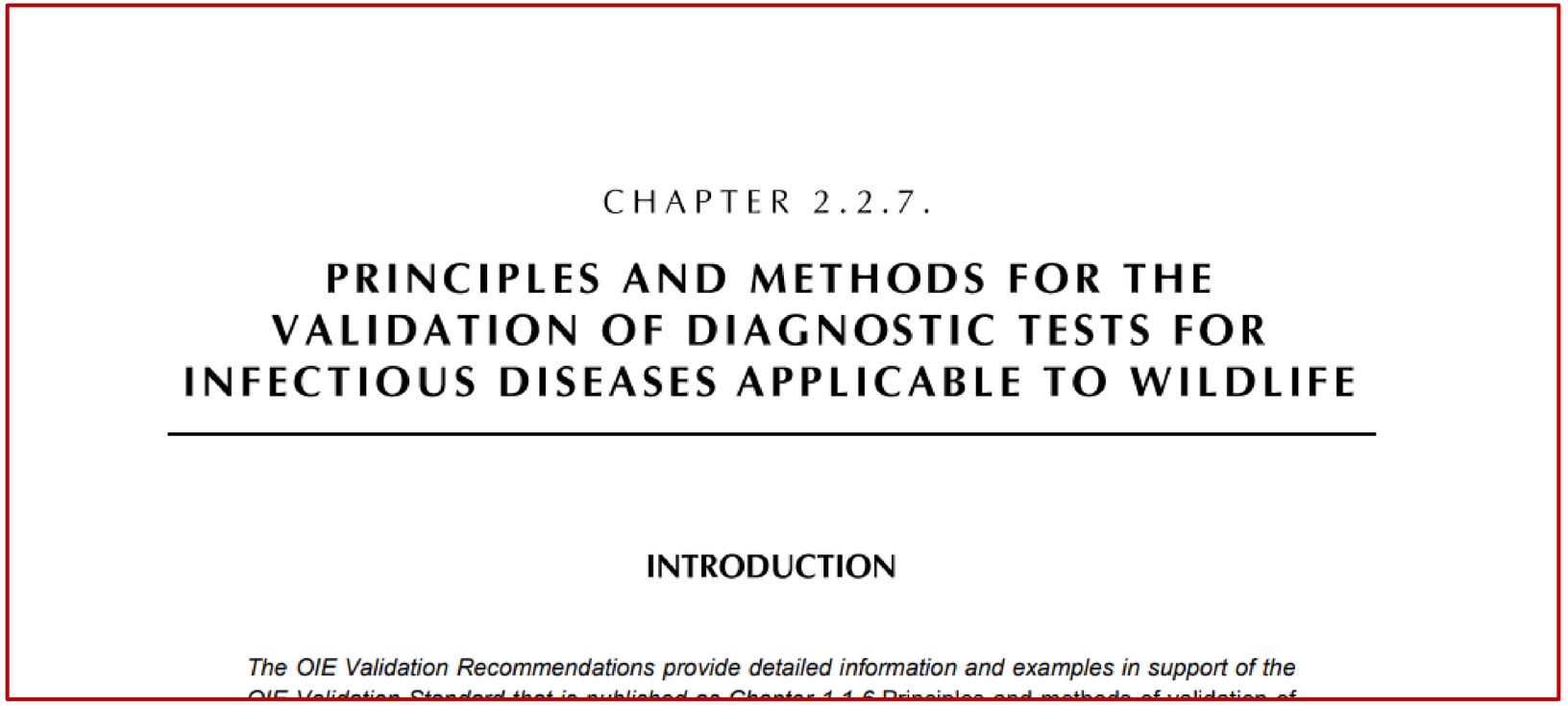
Salmonella choleraesuis

Validation is a process that determines the fitness of an assay, which has been developed, optimized and standardised, for an intended purpose





WOAH Guidelines “Principles and methods for the validation of diagnostic tests for infectious diseases applicable to wildlife”



CHAPTER 2.2.7.

PRINCIPLES AND METHODS FOR THE VALIDATION OF DIAGNOSTIC TESTS FOR INFECTIOUS DISEASES APPLICABLE TO WILDLIFE

INTRODUCTION

The OIE Validation Recommendations provide detailed information and examples in support of the

Biobanks/archives of samples

- Reference samples
- Confirmatory testing
- Collection of strains
- R&D

Virology 468-470 (2014) 104–112

Contents lists available at ScienceDirect

Virology

journal homepage: www.elsevier.com/locate/yviro

Molecular evolution and antigenic variation of European brown hare syndrome virus (EBHSV)

Ana M. Lopes [a,b,c], Lorenzo Capucci [d], Dolores Gavier-Widén [e,f], Ghislaine Le Gall-Reculé [g,h], Emiliana Brocchi [d], Ilaria Barbieri [d], Agnès Quéméner [c], Jacques Le Pendu [c], Jemma L. Geoghegan [i], Edward C. Holmes [i], Pedro J. Esteves [a,b,j], Joana Abrantes [a,*]

[a] CIBIO-UP, Centro de Investigação em Biodiversidade e Recursos Genéticos-Universidade do Porto/InBIO, Laboratório Associado, Vairão, Portugal
[b] Departamento de Biologia, Faculdade de Ciências da Universidade do Porto, Porto, Portugal

Frozen tissues bank of wildlife samples at SVA

3. Information management: Data

Computerized database or archive of surveillance data (5th Cycle Training Manual on Wildlife Health Information Management)

- Data management with safeguards
- Collecting data in the field (GPS data, digital platforms/tools)
- Permissions: who needs to see the data, and in what format? GDPR issues? Open data?
- Where is the data stored? Data archiving and accessibility
- Connectivity: considering links to other reporting systems (such as WAHIS-Wild) in the design of a database can allow for streamlined reporting functions

Wildlife population monitoring: the denominator data ("susceptible population")

efsa EUROPEAN FOOD SAFETY AUTHORITY

ENETWILD

Enhancing European Capacity for Wildlife Pathogen Risk Assessment

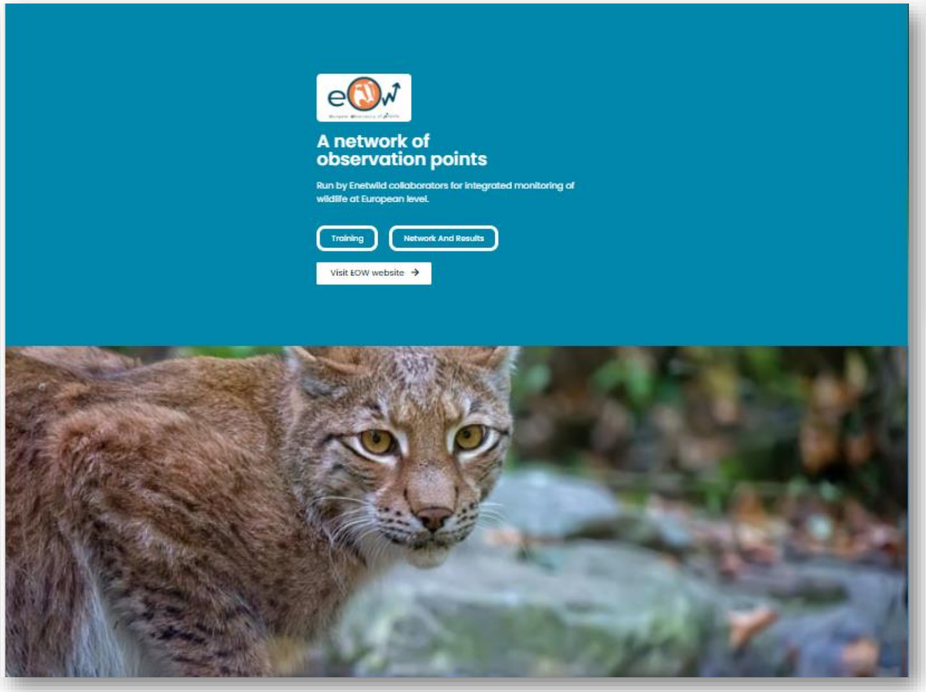
Accurate risk assessment of pathogens with implications for both human and live
presence and abundance of wild species, which often serve as reservoirs for thes

In Europe, various countries and organizations diligently collect spatial data on th
exist in the methodologies employed, the types of data acquired, and the accessi

The Europe

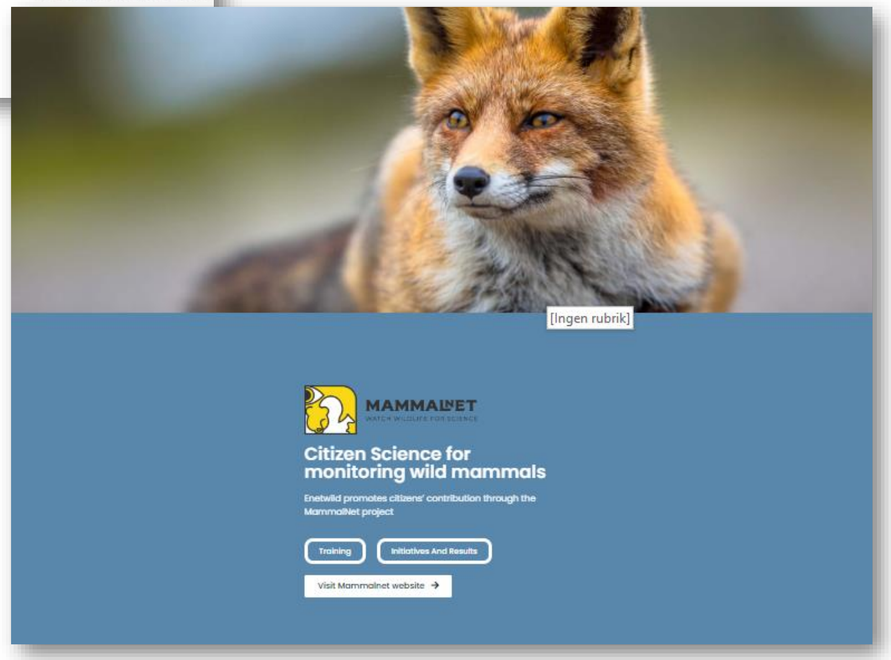
The European Foc
championing a p
European scale. T
disease risks shar
only serve critical
effective conserv

https://enetwild.com/the-project/

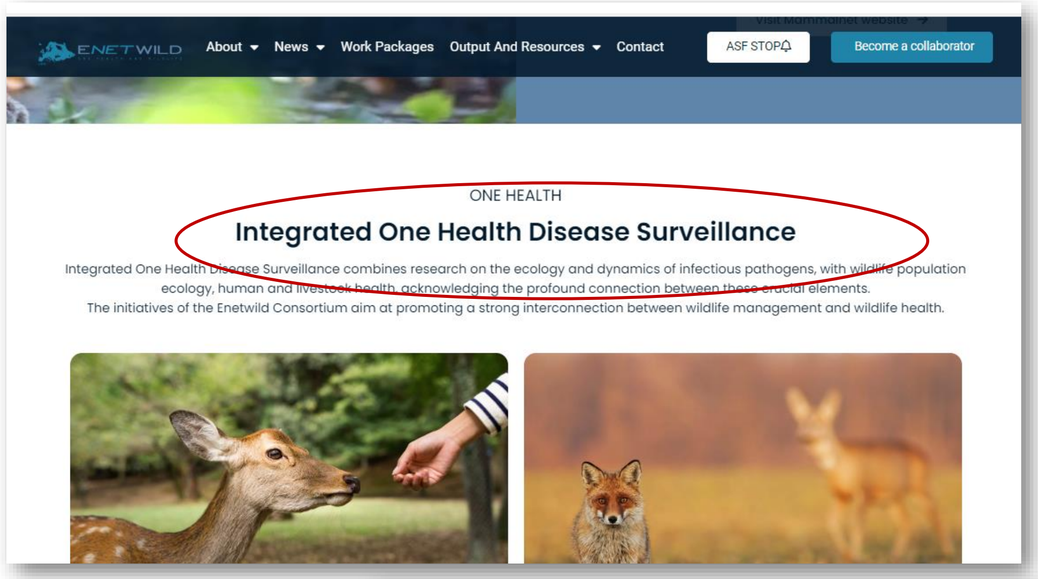


https://wildlifeobservatory.org/

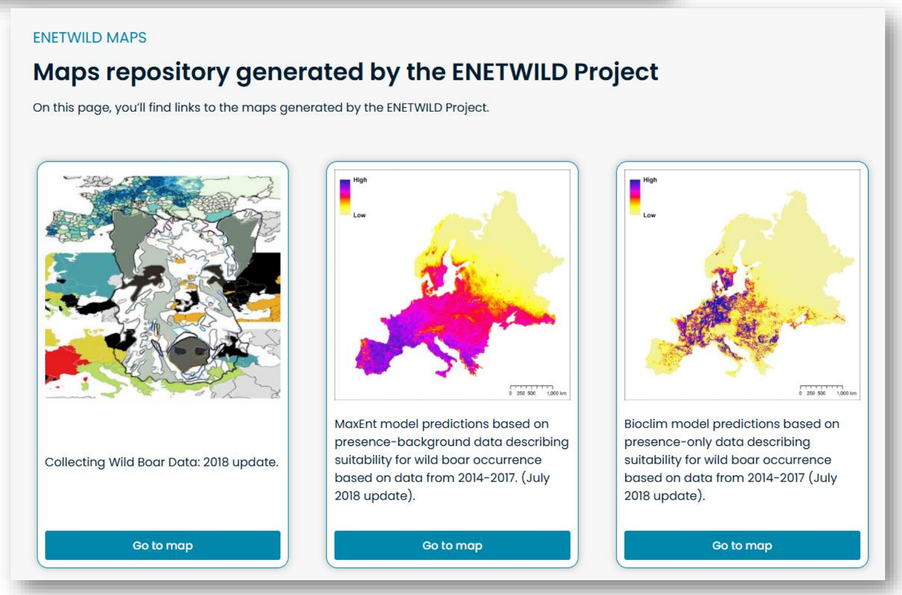
Mammalnet - Citizen Science

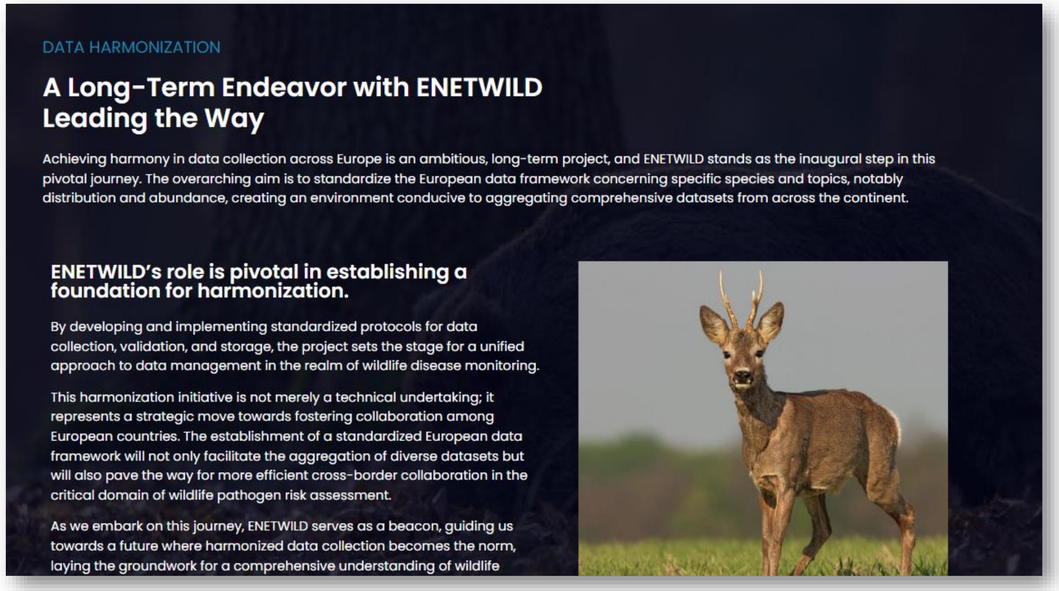


ENETWILD 2.0: distribution, abundance and structure of selected wildlife species populations



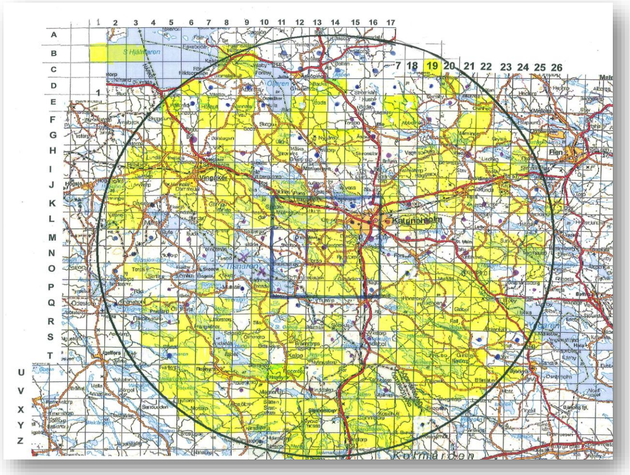
Integrated One Health surveillance

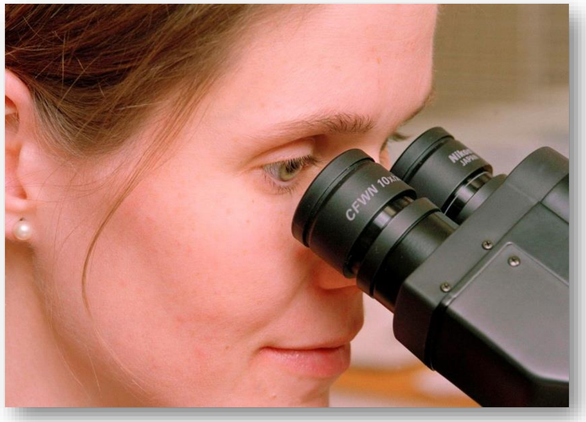


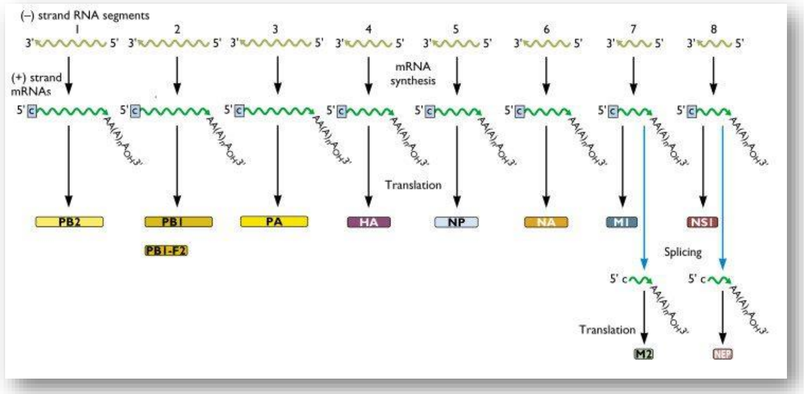


Data harmonization

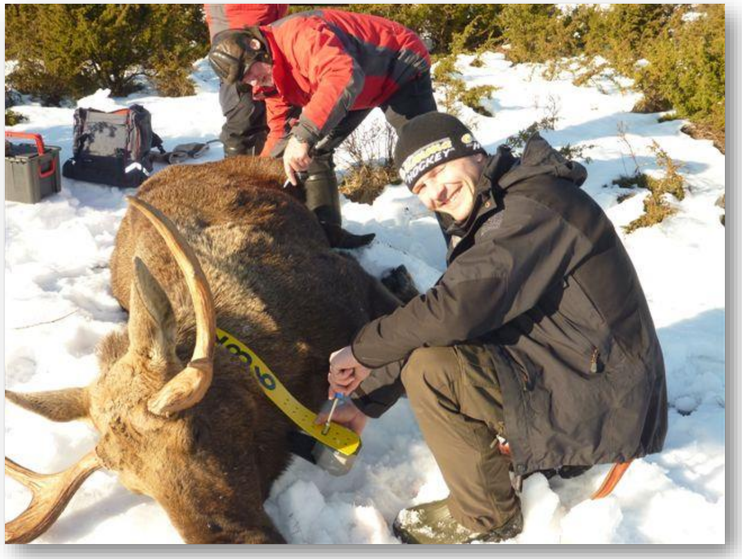
One Health collaboration-Integrating data







https://virology.ws/2009/05/01/influenza-virus-rna-genome/



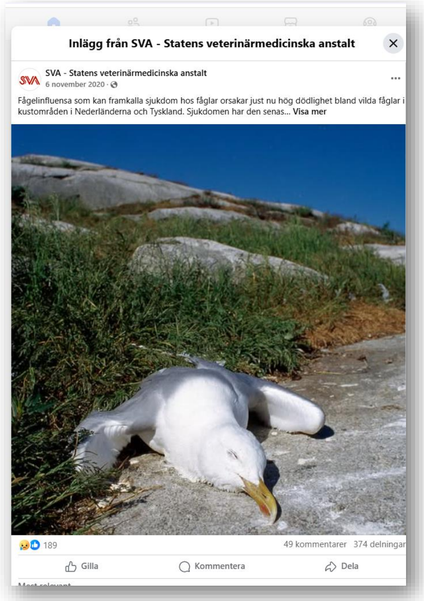
4. Analysis (of data) and communication

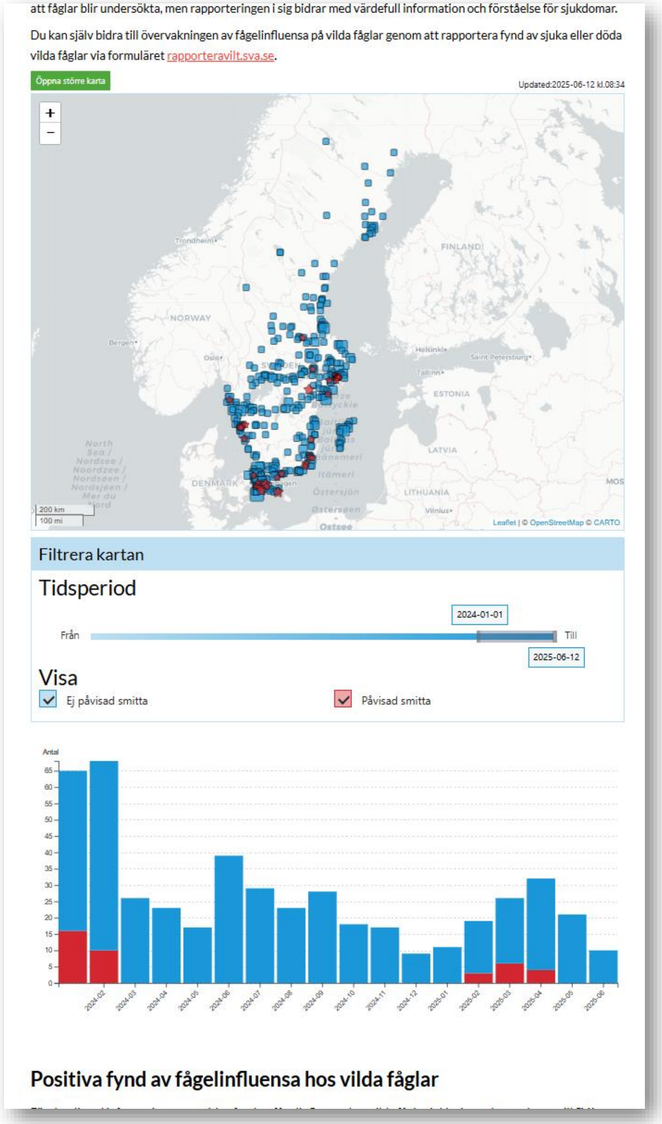
1st Statistical and epidemiological analysis

2nd Communicating results of surveillance

Important: pre-established plan and chain command of communication

- Communication to the public: press release, media,
- Feed-back to submitters
- Reports
- Scientific articles
- Social media
- Web-based





[Fågelinfluensa — smittläge med karta - SVA]

5. Taking action

- ✓ Management of diseases
- ✓ Restricted areas, restricted access of public
- ✓ Conservation is important (IUCN)
- ✓ Culling may be needed (but emphasize importance of protecting wildlife as much as possible!)
- ✓ Legislation

- ➢ Co-design of actions and measures: involve all interested actors (“stakeholders”)
- ➢ Social sciences

Types of Wildlife Health/Disease Surveillance (WDS)

General surveillance (passive or scanning): pathological examination of animals found dead or moribund. Capable of detecting any disease or pathogen

Targeted surveillance (active): testing animals for the presence of a specific disease/pathogen

Active and passive surveillance are complementary

Targeted/active wildlife health surveillance

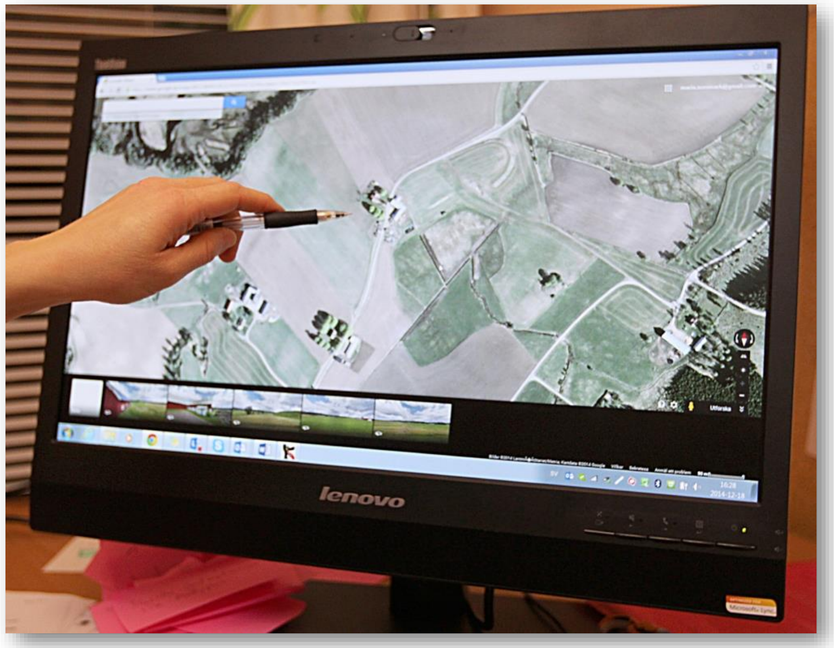
- Testing for one or more specific pathogen(s)/disease(s)
- In healthy or diseased animals, often healthy, hunted
- In one or more wild animal host species
- Priorities and criteria for the inclusion of pathogens vary
- Serology or antigen/pathogen detection

How?

Same 5 components as general surveillance

Sampling Design

- ✓ Metrics
- ✓ What host species should be sampled
- ✓ Where should samples be collected
- ✓ Sample Size – How many geographical units should be included
- ✓ Sample Size – How many surveillance samples need to be collected within a geographical unit
- ✓ Which animals to sample within an area or population of interest
- ✓ Bias



What host species?

Bovine tuberculosis: natural susceptibility and propensity to develop severe disease varies among species

High

Red fox

Brown rat

Low

What host species?

Table 2. The main groups of terrestrial vertebrate wild hosts, as well as potential wild sentinel species for the 10 elected list of pathogens (*E. granulosus* and *E. multilocularis* were considered separately). Vector borne pathogens are indicated in colour (for Q-fever, a relevant role in transmission by ticks is not clear).

Pathogen	Main groups of terrestrial vertebrate wild hosts	Wild sentinels
HPAI	Wild birds, mainly waterfowl as primary reservoirs and birds those in close contact	Waterfowl
Swine Influenza	Wild boar	Carnivores?
West Nile Disease	Birds and mammals (also reptiles)	Passive: Falcons, corvids; active: sparrows, pigeons, but ideally wild bird should be determined locally on the basis of seroprevalence studies
TBE	*Ixodes* and Small mammals are the main reservoir. Larger mammals, birds and reptiles can support viral maintenance indirectly	Rodents (*M. arvalis*). Non competent hosts such as wild ungulates (antibodies).
E. granulosus	Large canids as definitive host; Ungulates - intermediate host	Wolf (adult forms), wild boar, roe deer (locally, the ungulate species may vary)
E. multilocularis	Small canids (red fox, raccoon dog) - Definitive hosts; Rodents - intermediate host	Red fox, among murids, *Apodemus* spp
CCHF	Ticks are true reservoir (migratory birds from Africa harbouring CCHFV-infected ticks). Amplifying wild vertebrate hosts	Red deer (serology, long life span), ticks (*Hyalomma*, pathogen detection)
Hepatitis E	Wil boar and other Ungulates for specific subtype. Wild mammals and birds for other specific subtypes. Environment (water)	Wild boar and red deer for specific subtype
Lyme Borreliosis	Wild mammals (e.g., hedgehogs, voles, wood mice, red fox, reindeer, and birds)	Canids. Hedgehogs, squirrels, and blackbirds (tested by PCR in central Europe, spp. which tends towards synurbization)
Q-fever	Wild ruminants, micromammals, lagomorphs, environment	Rodents, predator (foxes) species could act as indicators for the presence of *C. burnetii* in rodents
Rift Valley Fever	Wild ruminant ungulates are potential reservoir where endemic (specially where their density is high) abroad Europe. Although not yet identified, bats and rodents may be implicated, but their epidemiological role in virus transmission and maintenance is not clear	No data available on the susceptibility of European wild ruminants to RVFV, or the capacity of the virus of causing a detectable viraemia. Need to be tested in rodents

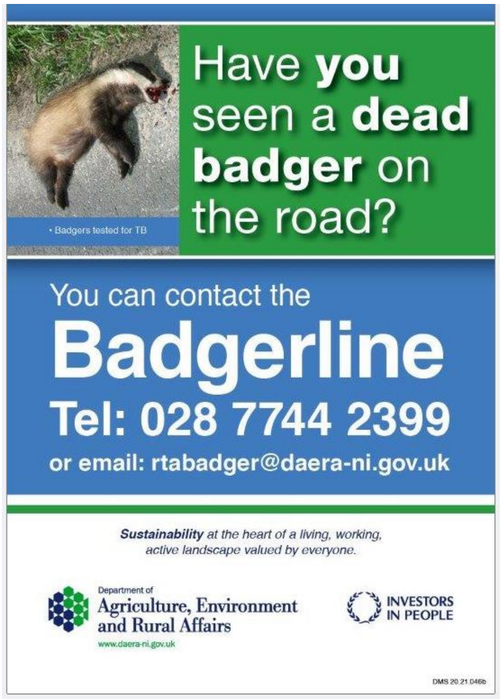
https://doi.org/10.2903/sp.efsa.2023.EN-7812 EFSA 2023

Sampling Design: logistical factors

Collaborate with hunters, ornithologists, rangers, researchers, etc

https://avesnature.com.pl/en/experts/ornithologist/

Intermediate horseshoe bat (***Rhinolophus affinis***)



https://www.daera-ni.gov.uk/articles/badger-road-traffic-accident-rta-survey

Sampling design: logistical factors, zoonoses

European Centre for Disease Prevention and Control
An agency of the European Union

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Home > About ECDC > Media centre > Tick-borne encephalitis (TBE) in Europe: new maps published

Media centre

Tick-borne encephalitis (TBE) in Europe: new maps published

News
15 Apr 2025

Translate this page

New maps published by ECDC show that hotspots for tick-borne encephalitis (TBE) in the EU are mainly concentrated in Central, Eastern, and Northern Europe, based on 2023 notification rates of locally-acquired cases.

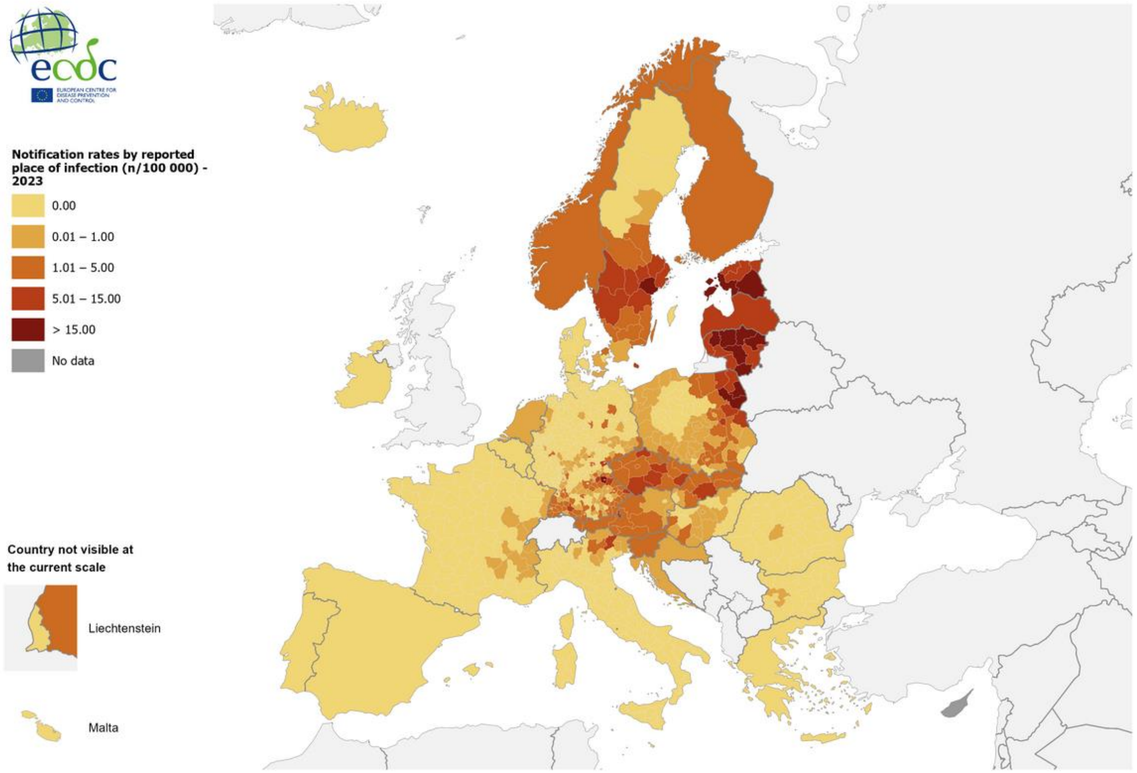
Infectious disease topics | Publications and data | Training and tools | About ECDC

Home > Notification rates of locally-acquired cases reported for 2023

Notification rates of locally-acquired cases reported for 2023

Map
10 Apr 2025

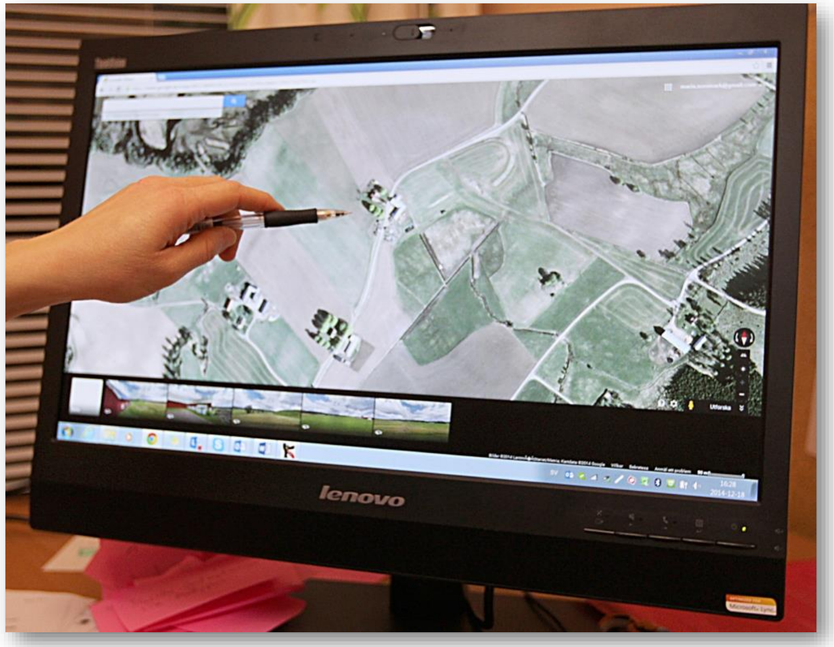
Translate this page



Administrative boundaries: ©EuroGeographics ©UN-FAO. The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union. Map produced by ECDC on 09 April 2025.

Sampling design: Where should samples be collected

- Overall spatial extent (geographical region)
- Depends on purpose/objective
- Along border regions
- Urban areas for certain zoonoses
- In and around farms
- Location of the wildlife populations, seasonality, migration

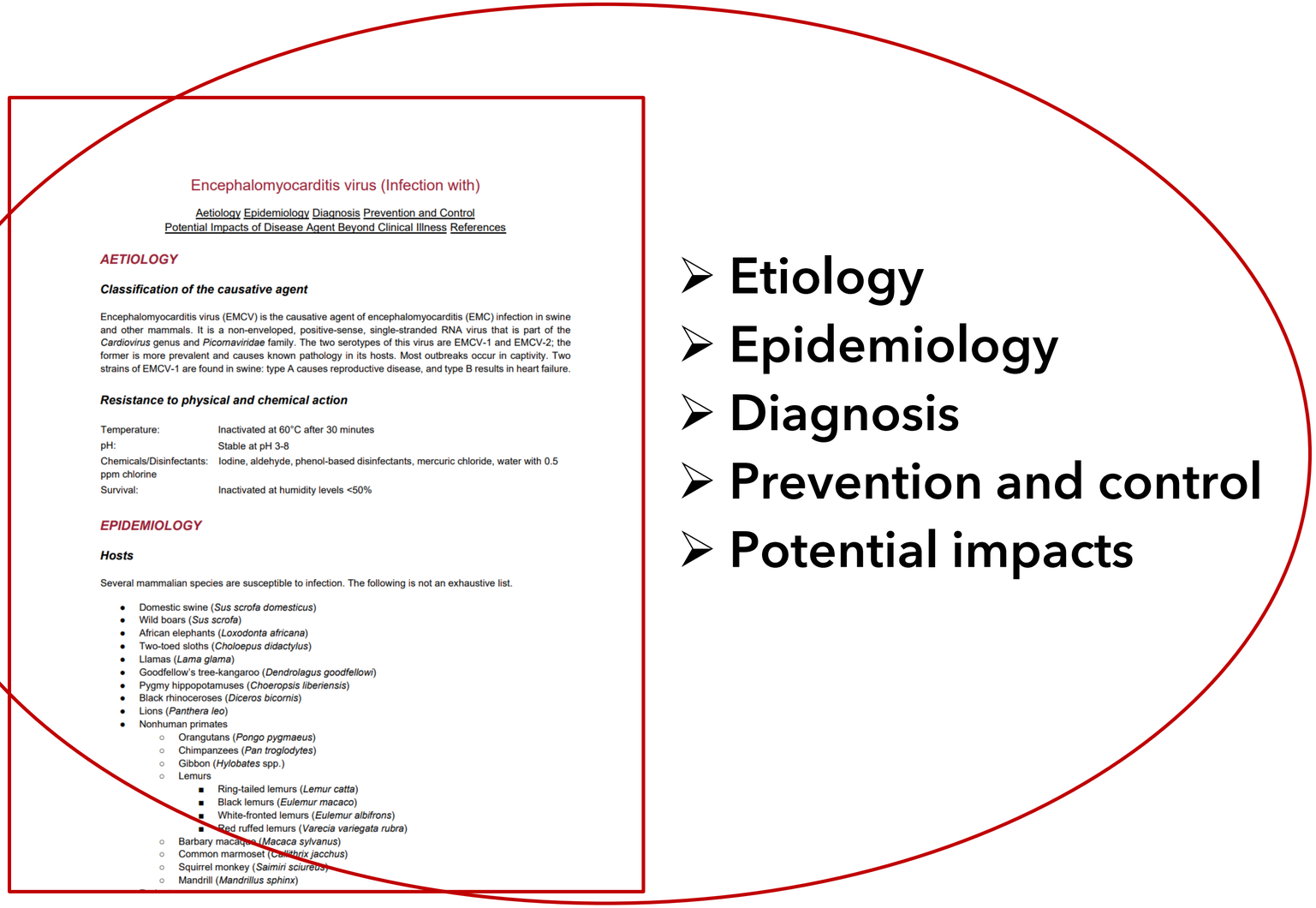


Wildlife sample collection for diagnostic testing: choosing a sample type

Table 1. Common sample types used to detect the presence or exposure of disease-causing agents in wildlife. The Disease Technical Cards for non-WOAH listed diseases provide additional information on the type of samples and testing needed for important wildlife diseases.

Sample type	Uses	Examples	Comments
Intact carcasses	Cause of death/ morbidity determination	Various infectious (viral, bacterial, parasitic) or noninfectious agents (toxic substances)	Allows testing of multiple tissues for multiple pathogens and examination of tissues for gross and microscopic lesions
Blood	Evidence of exposure or previous exposure to various pathogens (i.e., anitbodies) and contaminants (e.g., residues or altered enzyme activity) and presence of blood borne pathogens (e.g., hematozoa)	Morbilliviruses, elephant endotheoliotropic herpevirus, equine influenza Lead, insecticide poisoning, mercury, polychlorinated biphenyls Malaria, leucocytozoonosis, babesiosis	Whether antibodies indicate current infection or previous exposure is disease dependent and sometimes species dependent. Paired testing of individual can sometimes be used to establish infection status.
Swabs	Pathogen presence, shedding	Avian influenza (cloacal and oral pharyngeal/tracheal swabs), Batrachochytrium dendrobatidis (skin swab)	Useful for sampling large numbers of specimens for single pathogen (targeted surveillance); does not indicate whether pathogen is causing disease
Feces	Pathogen shedding, presence of parasites,	Salmonella, Escherichia coli, Cryptosporidium spp., Paratuberculosis Toxoplasmosis gondii, Sarcocystis neurona	Useful for determining presence of pathogen or parasite in population or area when animal capture not feasible. Difficult to pair results with individual animals. Does not indicate whether pathogen is causing disease in the population.

Disease Technical Cards for non-WOAH listed diseases



Encephalomyocarditis virus (Infection with)

Aetiology Epidemiology Diagnosis Prevention and Control
Potential Impacts of Disease Agent Beyond Clinical Illness References

AETIOLOGY

Classification of the causative agent

Encephalomyocarditis virus (EMCV) is the causative agent of encephalomyocarditis (EMC) infection in swine and other mammals. It is a non-enveloped, positive-sense, single-stranded RNA virus that is part of the *Cardiovirus* genus and *Picornaviridae* family. The two serotypes of this virus are EMCV-1 and EMCV-2; the former is more prevalent and causes known pathology in its hosts. Most outbreaks occur in captivity. Two strains of EMCV-1 are found in swine: type A causes reproductive disease, and type B results in heart failure.

Resistance to physical and chemical action

Temperature:	Inactivated at 60°C after 30 minutes
pH:	Stable at pH 3-8
Chemicals/Disinfectants:	Iodine, aldehyde, phenol-based disinfectants, mercuric chloride, water with 0.5 ppm chlorine
Survival:	Inactivated at humidity levels <50%

EPIDEMIOLOGY

Hosts

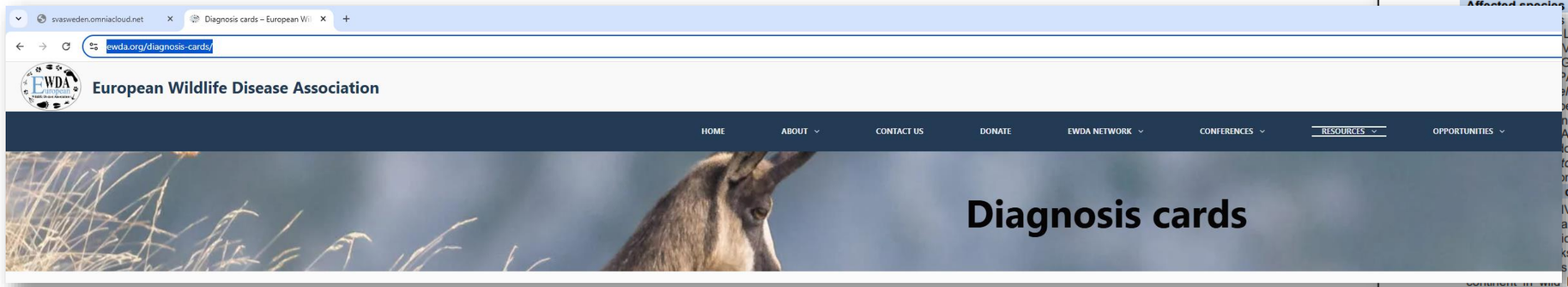
Several mammalian species are susceptible to infection. The following is not an exhaustive list.

- Domestic swine (*Sus scrofa domesticus*)
- Wild boars (*Sus scrofa*)
- African elephants (*Loxodonta africana*)
- Two-toed sloths (*Choloepus didactylus*)
- Llamas (*Lama glama*)
- Goodfellow's tree-kangaroo (*Dendrolagus goodfellowi*)
- Pygmy hippopotamuses (*Choeropsis liberiensis*)
- Black rhinoceroses (*Diceros bicornis*)
- Lions (*Panthera leo*)
- Nonhuman primates
  - Orangutans (*Pongo pygmaeus*)
  - Chimpanzees (*Pan troglodytes*)
  - Gibbon (*Hylobates* spp.)
  - Lemurs
    - Ring-tailed lemurs (*Lemur catta*)
    - Black lemurs (*Eulemur macaco*)
    - White-fronted lemurs (*Eulemur albifrons*)
    - Red ruffed lemurs (*Varecia variegata rubra*)
  - Barbary macaques (*Macaca sylvanus*)
  - Common marmoset (*Callithrix jacchus*)
  - Squirrel monkey (*Saimiri sciureus*)
  - Mandrill (*Mandrillus sphinx*)

- Etiology
- Epidemiology
- Diagnosis
- Prevention and control
- Potential impacts

Wildlife sample collection for diagnostic testing: choosing a sample type

EWDA diagnosis cards



https://ewda.org/diagnosis-cards/

Network for wildlife health surveillance in Europe

EWDA Diagnosis Card

Avian Influenza

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Last update

02.03.2021

Etiology

Caused by influenza A virus, family *Orthomyxoviridae*. Enveloped virus with single-strand negative RNA divided into 8 segments. Divided into subtypes according to antigenic variation in hemagglutinin (HA, 16 subtypes) and neuraminidase (NA, 9 subtypes) glycoproteins. Also divided in low (LPAIV) and high pathogenic avian influenza viruses (HPAIV) based on pathogenicity for chickens.

Affected species (wildlife, domestic animals, humans)

s are wild waterbirds, especially Anseriformes and Charadriiformes, in which they are LPAIVs also infect poultry. In terrestrial poultry, LPAIVs of H5 and H7 subtypes may Vs. HPAIVs are typically restricted to poultry but may spill over to wild birds. HPAIV Guangdong lineage (Gs/Gd) can infect and cause disease and death in a wide range PAIV can also infect mammalian species, have caused disease in pilot whales *elas*), harbour seals (*Phoca vitulina*) and American mink (*Mustela vison*), and have pendent lineages in domestic horses, domestic pigs, domestic dogs and humans. nce of LPAIV infection exists in other mammalian species. Sporadic HPAIV infections AIV H5N1 sporadically observed in a wider range of mammals, including domestic ogs, tigers (*Panthera tigris*), leopards (*Panthera pardus*), Owston's palm civets *toni*), stone martens (*Martes foina*), American mink, raccoon dogs (*Nyctereutes* omestic pigs, donkeys and humans.

characteristics and disease course

V infections typically epidemic in birds and mammals. LPAIV prevalence in wild ally peaks between late summer and early winter, depending on bird species and ions. LPAIV prevalence varies greatly across geographical areas and among bird s of HPAIV H5 Gs/Gd often associated with autumn migration. In recent years, some s belonging to H5 Gs/Gd lineage have been regularly circulating in the Eurasian birds (in particular Anseriformes) where they have reassorted with LPAI strains. Prevalence of infection and mortality due to these viruses in wild bird populations varies from year to year based on the characteristics of the strain and to the susceptibility of involved species. No clear seasonal or geographical patterns for LPAIV or HPAIV H5N1 outbreaks in mammals. There is a chance for some susceptible species of predators, such as wild felids and mustelids living in an area with numerous cases of HPAI, to become infected after eating infected birds.

Course of LPAIV and HPAIV acute infection, ending with the mounting of a specific immune response or death (HPAIV). Infection usually lasts 4 to 8 days but may continue up to several weeks. LPAIV mostly infects the epithelium of the digestive tract and bursa of Fabricius in wild birds, and the epithelium of the respiratory tract in mammals. HPAIV H5 Gs/Gd infects respiratory epithelium and the parenchymal cells of internal organs, including pancreas, liver, kidney, adrenal glands, and brain in birds and mammals. Endothelium is rarely infected but has been reported in swans.

Clinical signs

Birds: LPAIV infection generally subclinical. HPAIV H5 Gs/Gd in wild birds sub-clinical to fatal. HPAIV H5 Gs/Gd infection in susceptible wild bird species causes prominent respiratory and neurological signs, including circling, ataxia and torticollis.

Mammals: LPAIV can cause respiratory disease (fever, weight loss, dry cough, labored breathing, and nasal discharge) that may be fatal. HPAIV H5N1 generally results in severe respiratory and

The authors are responsible for the final contents of the card. Please refer to this card when you publish a study for which the APHAEA protocol has been applied. Reference suggestion: «This method is recommended by the EWDA Wildlife Disease Network (www.ewda.org)»; citation: Authors, Year, APHAEA/EWDA Diagnosis card: [name of disease], www.ewda.org

Other considerations

- ✓ Clearly defined roles and responsibilities
- ✓ Combined and coordinated expertise
- ✓ Legal framework
- ✓ Ethical considerations
- ✓ Biodiversity
- ✓ Reporting
- ✓ Evaluation and adaptation of WDS

Acknowledgements

SVAs wildlife team (www.SVA.se)