

The logo for DRAHS (Disease Risk Analysis & Health Surveillance) is a purple rounded rectangle. It contains the word "DRAHS" in large, white, bold, sans-serif capital letters. Below it, the words "Disease Risk Analysis" and "& Health Surveillance" are written in a smaller, white, sans-serif font, stacked on two lines.

DRAHS

Disease Risk Analysis
& Health Surveillance

The Natural England logo consists of a solid yellow square. Inside the square, the words "NATURAL" and "ENGLAND" are written in a white, sans-serif font, stacked vertically.

NATURAL
ENGLAND

Disease Risk Analysis for Water Vole Reintroductions

Helen Donald
DRAHS, Institute of Zoology

Disease risks of translocations

Introduced disease can decimate native populations

Squirrelpox



Chytridiomycosis

Disease risks of translocations

Alien parasites

- Years to develop
- Difficult to detect
- Difficult to resolve



Squirrel Pox

- *First introduced 1870s*
- *First detected 1930s*
- *First diagnosed 1979*
- *Significance established 1990s*
- *No solution*

What is disease?

What is disease?

- Absence of health

What is disease?


- Absence of health
- Infectious or non infectious
- Parasites:
 - Ectoparasites e.g. fleas
 - Endoparasites e.g. intestinal nematodes
- Bacteria
- Fungi
- Viruses



HS- Chronic cases- Necrotic patch on the liver



What is disease?

Infection  ***disease***

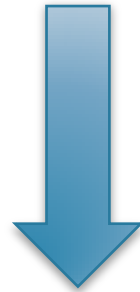
What is disease?

Infection



Latent infection

e.g. Chickenpox (Herpes virus)



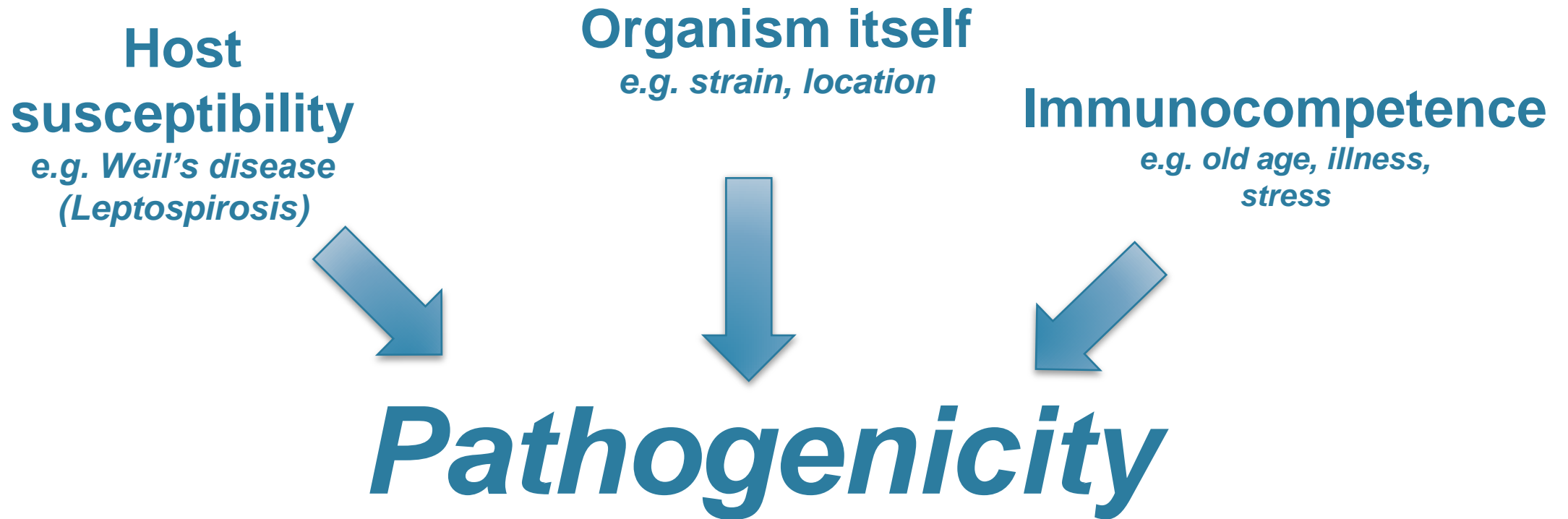
**Normal
commensals**
e.g. Streptococcus



Asymptomatic infection

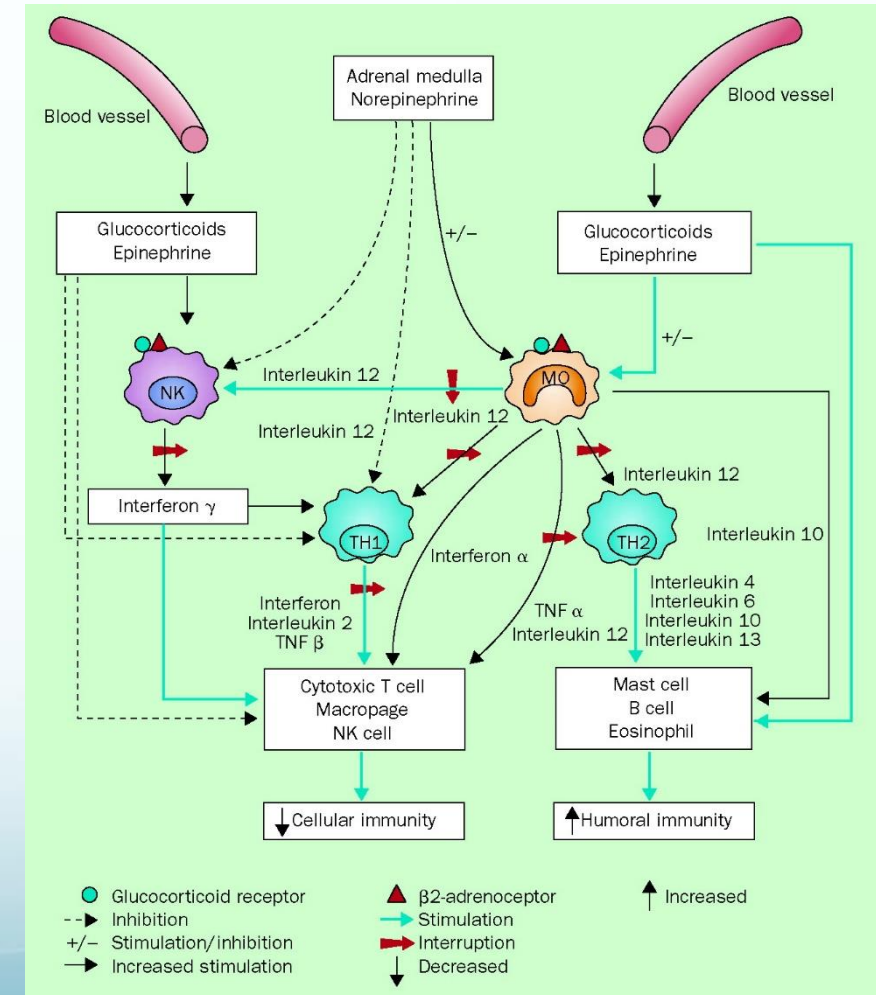
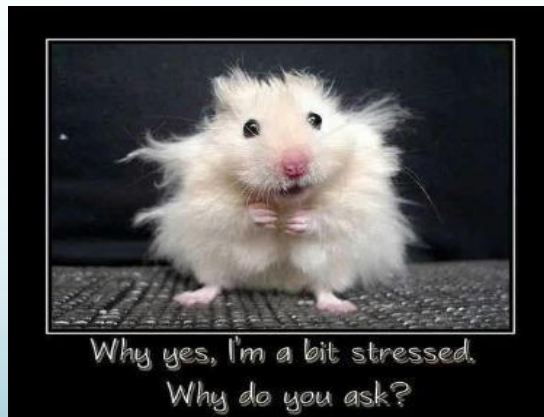
e.g. Typhoid Mary

What is disease?



Stress increases susceptibility to disease¹

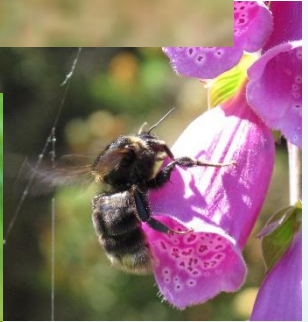
- Handling
- Transport
- Changes in population densities
- Adaptation to new environment



Minimising the risks of translocations

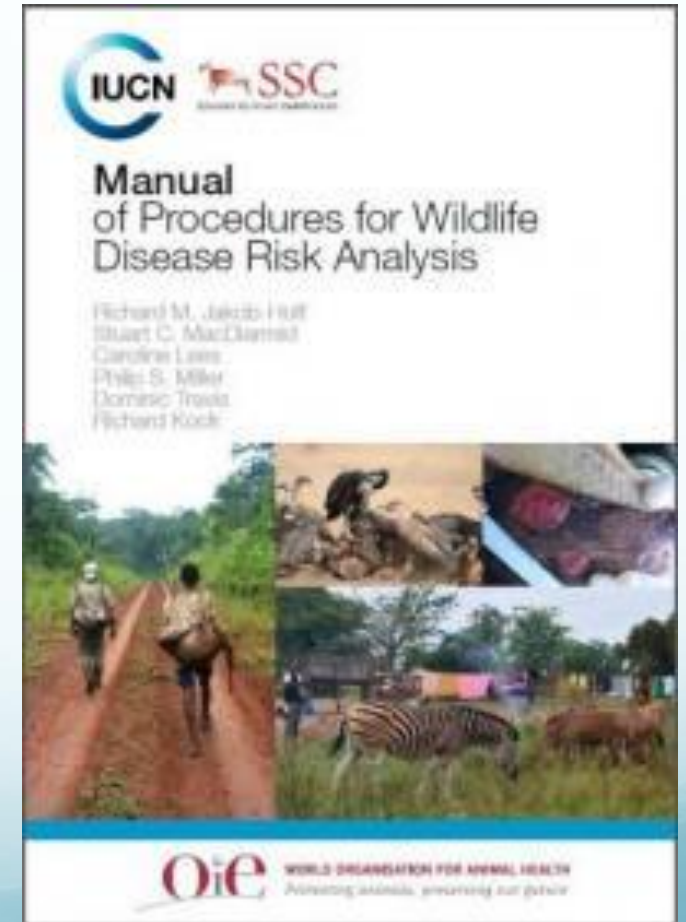
Disease risk analysis (DRA) and Disease risk management (DRM)

- a formal assessment of the health risks
- Aims to identify and manage the risks at every stage of the process
- Used in 28 projects since 1989, many as part of the Species Recovery Programme
- Post-Release Health Surveillance provides vital feedback and revisions



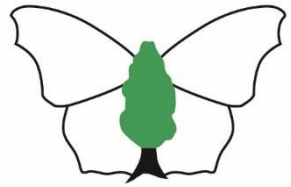
Disease risk analysis

- IUCN recommends DRA before any translocation
- DRAHS methods¹ now widely adopted and form the basis of guidelines



¹Sainsbury AW, Vaughan-Higgins RJ, 2012

Collaborations



**Butterfly
Conservation**

Saving butterflies, moths and our environment



Predatory Bird
Monitoring Scheme



Forestry Commission

**amphibian and reptile
conservation**



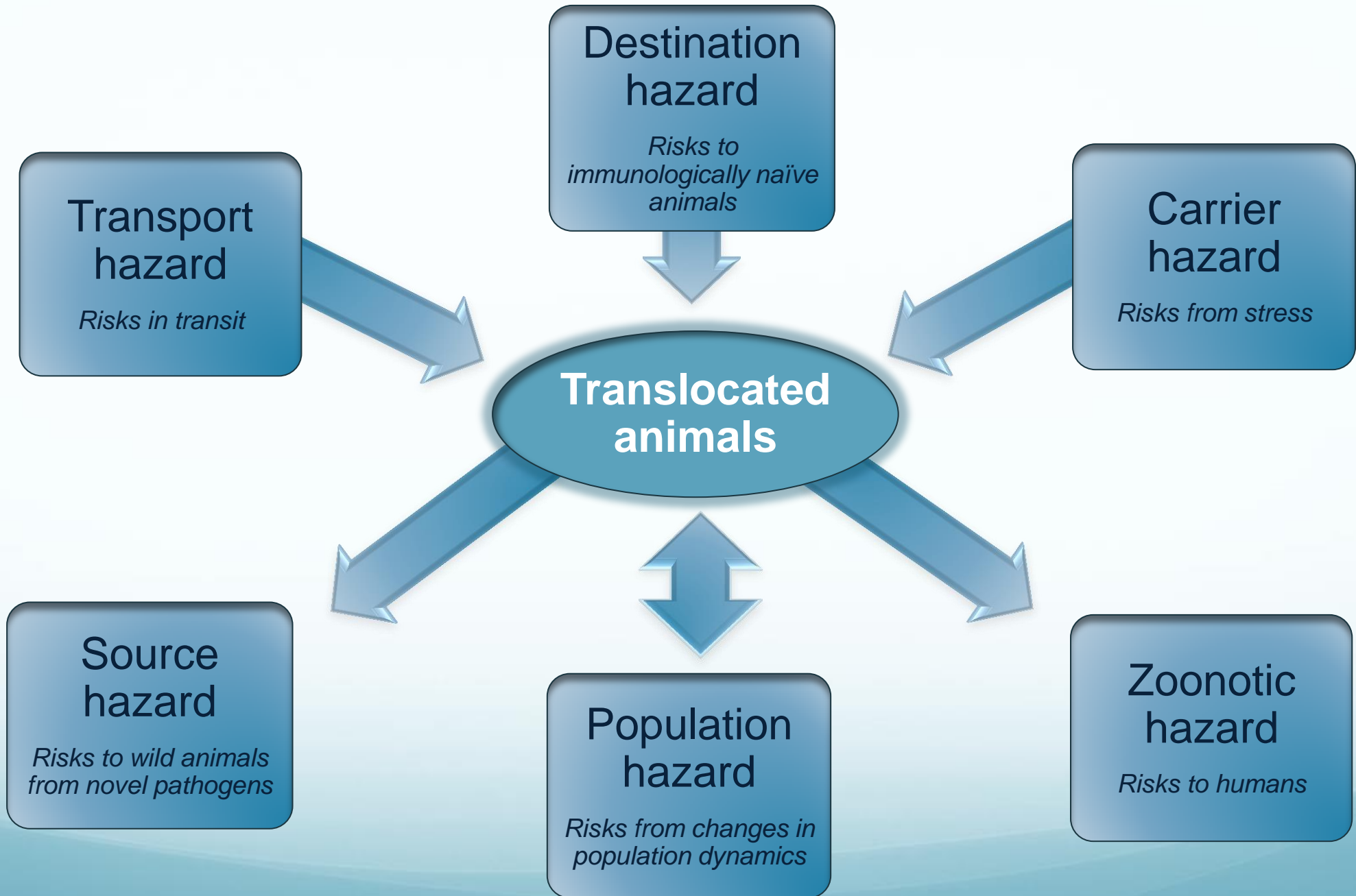
BTO
Looking out for birds

people's
trust for
endangered
species



**NATURAL
ENGLAND**





Examples of Hazards

Source Hazard

Novel pathogen accidentally introduced to the wild

- Upper respiratory tract disease in desert tortoises
- In 1988 disease first detected in wild tortoises
- 43% of 468 live tortoises affected
- High mortality - 627 carcasses recovered from wild
- Associated with release of captive tortoises



Examples of Hazards

Transport Hazard

Risk to health encountered in transit

- Partula snails extinct in the wild in Polynesia
- Bred in captivity in UK and USA
- Many died in transit in 2015 due to poor temperature regulation
- Transportation containers modified and further translocations all successful



Examples of Hazards

Carrier Hazard

Stress reduces immunity to normal commensal organism

- Isosporoid coccidia found in faeces of healthy Cirl buntings
- Reintroductions in Cornwall from 2006 to 2011 to boost population
- Deaths in chicks brought into captivity for rearing and release associated with high levels of *Isospora* infection
- Stress levels reduced through lower stocking density
- Subsequent rear/release programmes successful



Unpredictability

- Knowledge is often scant
- Unknown disease hazards in all translocations
- Essential to maintain biosecurity even in perceived low risk situations
- **Post-release health surveillance** for early detection of problems e.g. post mortem of all animals found dead



Water Vole DRA

- DRAHS commissioned by Natural England to conduct DRA for water vole reintroductions and make disease management recommendations
- DRA can take up to 2 years
- Research still in early stages and subject to change
- Reviews of scientific studies into diseases of water voles and closely related species in UK and Europe



Risk is highest if a barrier is crossed

- Geographic
- Ecological



Disease risk from water vole reintroductions

- Are geographic or ecological barriers being crossed?
- Could keeping water voles in captivity expose them to new parasites from contact with exotic species?
- Could reintroduced water voles introduce new parasites?
- Are water voles likely to encounter parasites they are naïve to on release?
- What is the impact of stress on disease susceptibility?
- What sensible measures can be put in place to manage risk from disease?



Geographic barriers

- Water voles are being introduced to areas they cannot re-colonise unaided
- But closely related sympatric species may increase the effective population¹
- Brown rats (*Rattus norvegicus*) and bank voles (*Myodes glareolus*) are ubiquitous in Great Britain²
- Parasites of concern can be transmitted indirectly e.g. via the environment or vectors

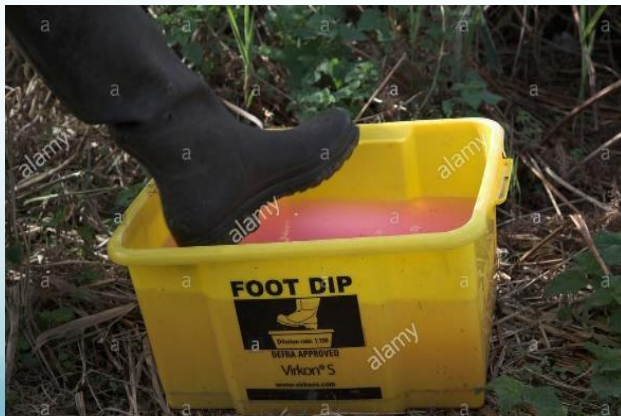


A contiguous population of susceptible animals means no geographic barriers to disease transmission reducing the risks

¹Mathews et al. (2006); ; ²Mammal Society (2018); PTES (2018)

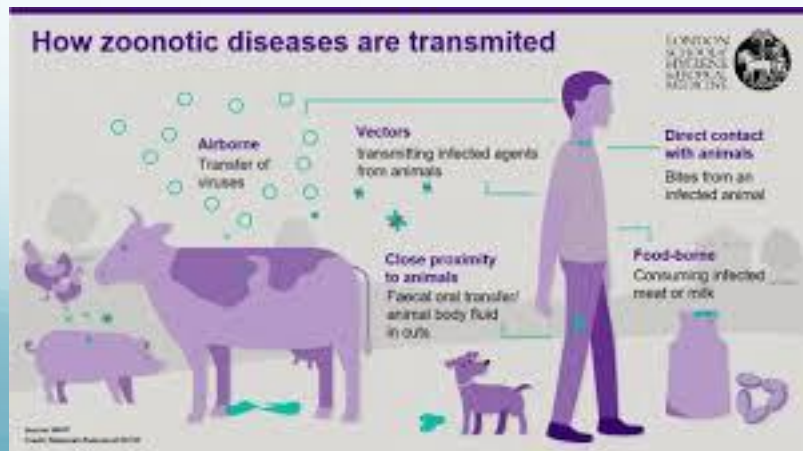
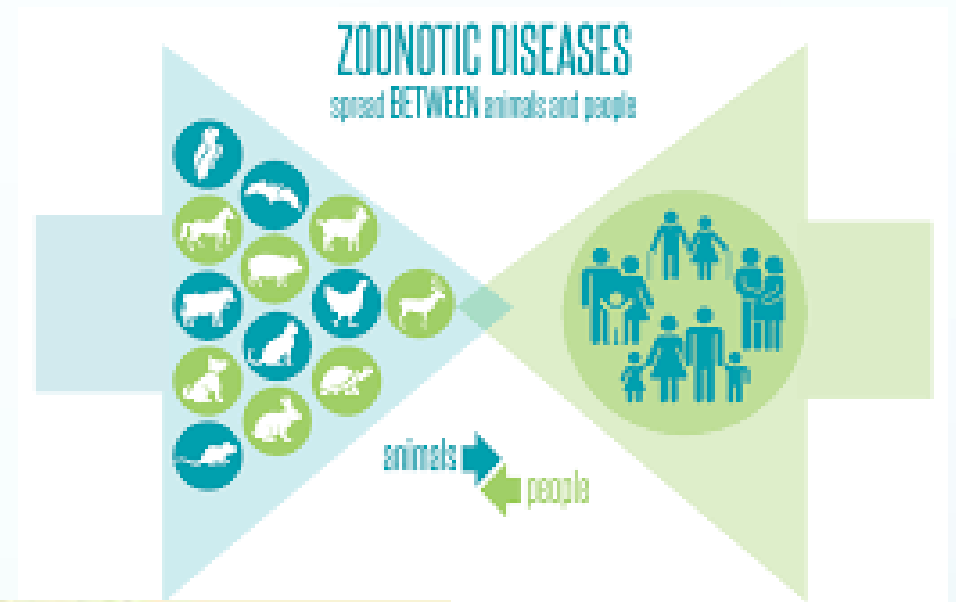
Ecological barriers

- Good biosecurity and separation of water voles from exotic species reduces the risk from novel parasites
- E.g. quarantine, dedicated staff and equipment, control of fomites, separation of water supplies



Zoonotic hazards

- Many parasites of water voles are zoonotic e.g. *Giardia*, *Campylobacter*, *E coli*, *Salmonella*
- Many persist in soil and water for long periods
- Good hygiene essential at all times



Carrier Hazards

- Organisms that do not normally cause disease in healthy animals
- At times of stress may cause significant disease because of reduced immunocompetence
- Translocations are a known stressor and this may affect reintroduction success¹
- Capture and handling are known sources of stress to water voles²

Are water voles being reintroduced at risk from carrier hazards?



¹Dickens et al., 2010; ²Moorhouse et al., 2006

Carrier hazards to water voles?

Leptospirosis and *Yersinia enterocolitica*

- Ubiquitous in wildlife
- Small rodents a known reservoir host
- Usually chronic, asymptomatic infection



Leptospirosis prevalence in water voles 40% post-reintroduction¹ compared to 6% in free-living water voles²



2 water voles in captivity with acute yersioniosis have died

¹Gelling et al., 2015; ²Gelling et al., 2011; ³Mathews et al., 2006; ⁴Baker, 2016

Carrier Hazard Management

Stress minimisation

- Can we reduce handling?
- Is all testing and treatment necessary?
- Small rodents are prey species: how can we minimise unfamiliar noises, vibrations and smells?
- How can we make release events as low key as possible?

Further research

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