Research on badgers and TB at Woodchester Park

Dez Delahay
National Wildlife Management Centre
Principal areas of work

- **Badger ecology and TB epidemiology in badger populations**
  - Woodchester Park study
  - Population level disease dynamics
  - Movement and contact behaviour
  - Individual life histories

- **Developing techniques**
  - Surveying and capture
  - Abundance estimation
  - TB diagnostics
  - Oral vaccine bait

- **Management of transmission between badgers and cattle**
  - Consequences of interventions
  - Vaccination
  - Understanding and managing interactions - biosecurity
Long term study of badgers & TB at Woodchester Park

- Study began in 1976
- 11 km$^2$ (7 km$^2$ core area)
- TB hotspot for cattle
- High badger density
- Short term ecological study?
Woodchester Park: Humble beginnings…….
Some things have changed……
The Woodchester Park badger study

Capture-mark-recapture study

- Routine capture and testing for TB
- Individuals are marked and released
- Unique database
  - >15000 capture events
  - >3000 individuals
  - Life histories

Infection status

- Culture (since 1976)
- Brock ELISA (since 1982)
- Categories = negative, exposed, excretor, super-excretor

Since 2006

- StatPak (antibodies)
- Gamma Interferon (Cellular – T cells)
TB in badgers

- Transmission routes:
  - Aerosol
  - Bite wounding

- Infected badgers can live for many years and reproduce successfully.

- Excretion in sputum, urine and faeces.

- Females more resilient

- Behavioural correlates
  - Sett use
  - Network position
  - Home range size and use
  - Bite wounding
  - Capture probability?

Temporal patterns of infection

Using all available information (unified Bayesian approach)
(adjusted Brock ELISA + culture + Stat-Pak + gamma-interferon)
Drivers of disease spread?

- Population density not a simple driver
- Population structure mitigates spread
- Individual and group risks increase with movement
- Consequences for management interventions (perturbation)

Investigating social behaviour & TB status

• Radio-tracking and proximity logger technology
• Test positive badgers are different,
  • Spend more time away from the main sett
  • Occupy different position in the social network
    • More isolated from group members
    • Nodes of ‘flow’
• Some individuals more important for disease spread
• What happens when we cull?
• How do we target infected individuals?

Developing techniques

Remove only infected or infectious individuals or groups

• Diagnostic test
  – Adequate sensitivity & specificity
  – Even a test with poor performance may be useful
  – Combine tests?

• Challenges of live testing in the field
  – Restraint trap
  – Blood sample conscious animals

• Combine with vaccination
Development of an oral vaccine

• **Formulation**
  - ‘Happy home’ for live BCG
  - Bait that is attractive to badgers
  - Labelled

• **Bait Preference**
  - Measure bait disappearance and use cameras to determine behaviour and preference
  - Selected leading bait (peanut based)

• **Bait Uptake**
  - Assess different deployment strategies
  - Biomarkers in bait to measure uptake
  - Cameras used to assess non-target interference
  - *Season, dispersal pattern & age differences*
Reducing contact between badgers and cattle

- Direct contact rare at pasture, indirect contact more frequent.
- Direct contact observed at troughs and in buildings.
- Contamination of feed in troughs and buildings.
- Visits to buildings vary in space and time.

Current Research

- Perturbation and disease dynamics in badger social networks (NERC, Exeter)
- Heritability of susceptibility to TB in badgers (NERC, Exeter)
- Senescence and TB progression in badgers (NERC, Exeter)
- A Bayesian model of TB dynamics in badgers (NERC, Exeter)
- *M. bovis* genome sequencing in badgers and cattle (BBSRC, Glasgow)
- Tick-borne pathogens in badgers (Salford)
- Microbiome variation in badgers (Exeter/ZSL)
- Energy expenditure and TB status (Queens Belfast)
Thank you

To all the Woodchester staff, APHA colleagues, students, University collaborators, defra, the Research Councils and local landowners