




Identifying Disease in Ticks

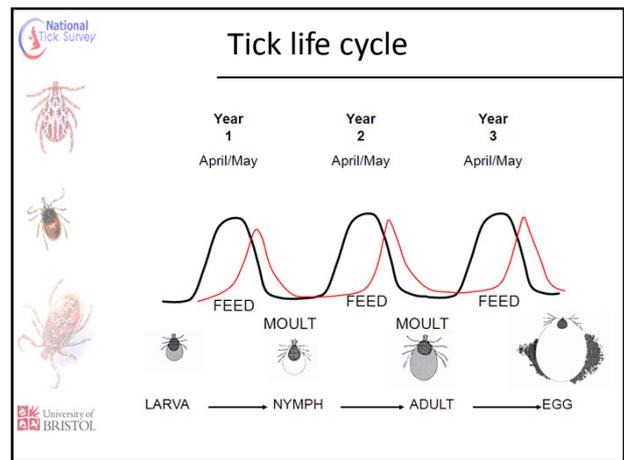
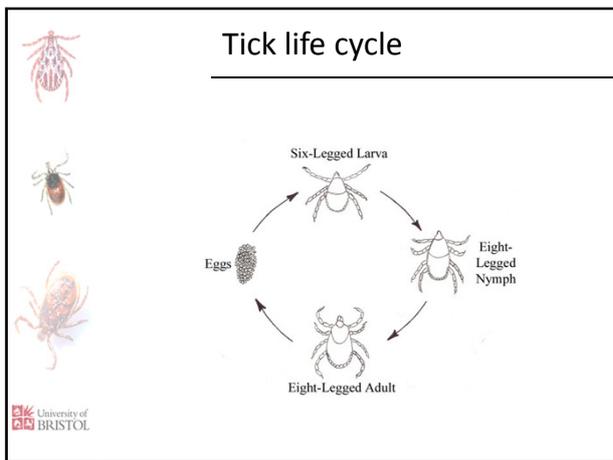
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Introduction

- Introduction
 - Tick biology and ecology
 - Ticks in the UK
 - Tick-borne Disease in the UK
- National Tick Survey






Environmental Conditions

- Suitable habitat (moorland, woodland etc)
- Host availability
- Soil threshold temperature: 6-8°C
- Optimal: 17-20°C
- Relative humidity above 80%





Ticks as disease vectors

- Long lived
- Attach securely to host
- High fecundity/high density
- Relatively non-host specific
- Large blood meals
- Trans-stadial transmission
- Trans-ovarial transmission
- Difficult to control off the host




Tick species in the UK

Ixodes ricinus

- Most common species in UK
- Woodland and moorland
- Vector of Lyme borreliosis.



National Tick Survey
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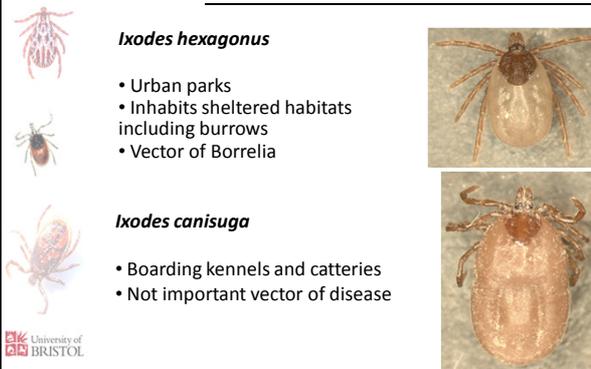
Tick species in the UK

Ixodes hexagonus

- Urban parks
- Inhabits sheltered habitats including burrows
- Vector of Borrelia

Ixodes canisuga

- Boarding kennels and catteries
- Not important vector of disease



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Tick species in the UK

Dermacentor reticulatus

- European Meadow Tick
- 'Exotic' species found in UK
- Hosts: livestock, cats and dogs



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UK distribution of ticks

- Distribution of *Ixodes ricinus* expanded by 17%.
- Perceived abundance increased at 73% of locations.
- Matches European patterns.



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Global distribution of ticks

Importance

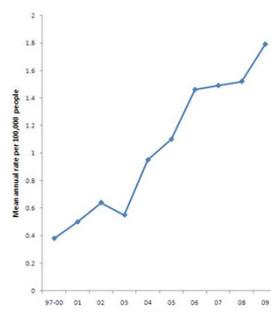
- Global warming
- Introduction of 'exotic' species
- Introduction of new tick-borne diseases



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Lyme disease prevalence

- Lyme disease cases:
 - 2000 – 0.38 per 100,000 people
 - 2009 – 1.79 per 100,000 people
- Four-fold increase!
- 2010 – 953 reported cases, but underreported.
- WHY??



Year	Mean annual rate per 100,000 people
97-00	0.38
01	0.5
02	0.65
03	0.55
04	0.95
05	1.1
06	1.45
07	1.5
08	1.55
09	1.79

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 **Lyme disease**

Reasons for Lyme increase:

- Enhanced surveillance
- More sensitive diagnostic tools
- More diagnostic facilities
- Increase in visitors to Lyme endemic areas
- Eastern European migrants
- Changes in *I. ricinus* abundance and distribution
- Increases in populations of reservoir hosts



 **Lyme disease**

Cost of Lyme disease:

- Physician and hospital appointments
- Laboratory tests
- Antibiotic therapy
- Scotland – loss of £331,000 per year (Joss et al., 2002)
- Not including loss of working hours and potential decrease in tourism to tick hotspots



 **PhD aims**

1. Distribution and abundance of ticks
2. Distribution and prevalence of disease



 **Methods**

Tick Survey – March-October 2009

- 173 vet practices
- 5 dogs/week chosen at random
- Dog examined



 **Methods**

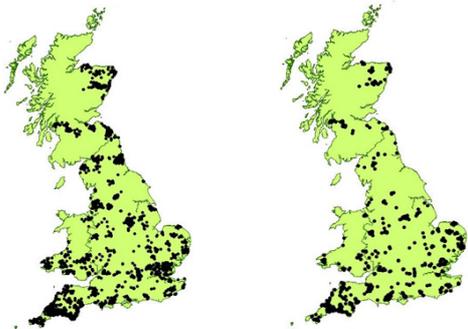
Tick Survey – March-October 2009

- Questionnaire – Risk Factors
 - Dog movement
 - Dog breed/age/sex
 - Preventative treatment
- Ticks identified
- PCR analysis for disease



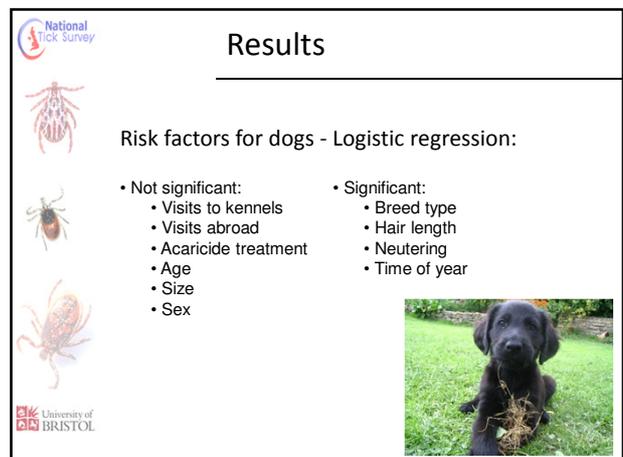
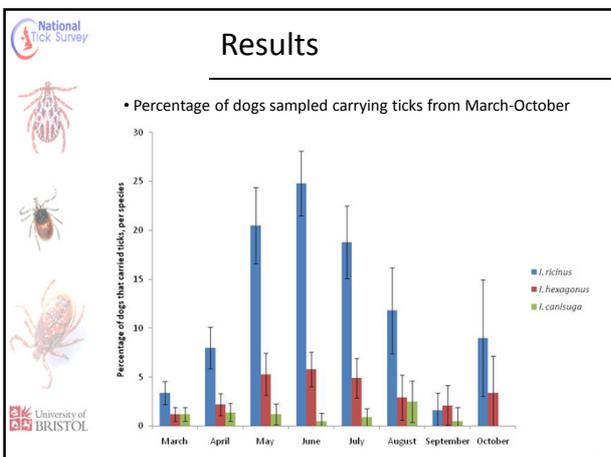
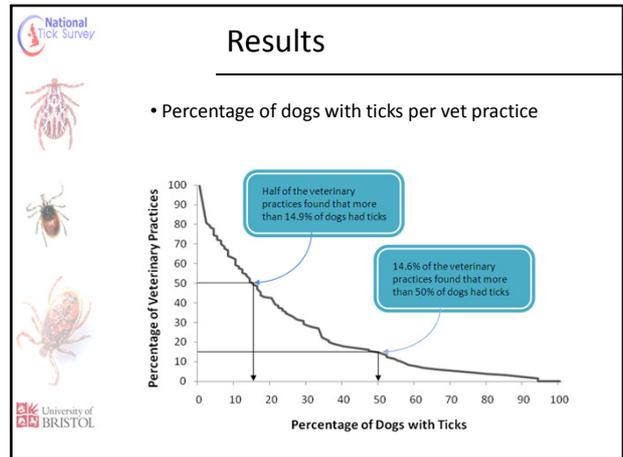
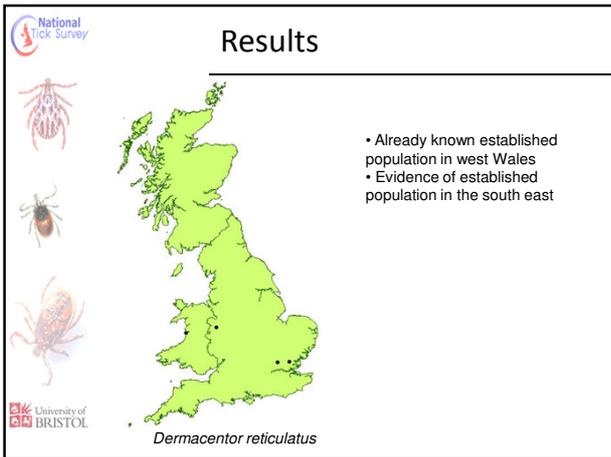
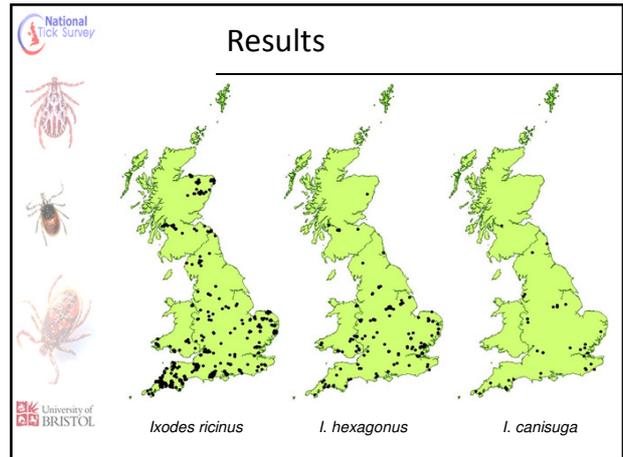
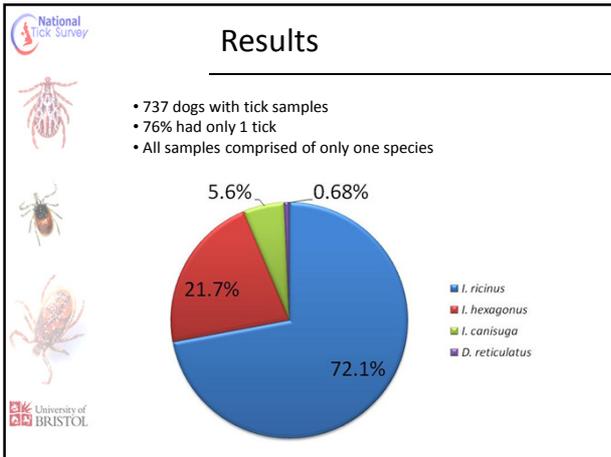


 **Results**



• 3534 replies • 810 dogs with ticks





 **Identifying disease in ticks**

- DNA extraction
- Polymerase chain reaction
- Gel electrophoresis




 **DNA extraction**

- Ticks stored in alcohol and freezer (-20°C)
- Tick tissue exposed
- QIAamp DNA kit

 **PCR technique**

- Polymerase Chain Reaction
- Primers recognise *Borrelia* DNA
- Cycles of heating and cooling
- DNA is exponentially replicated




 **Results**






 **Results**

- Usually Lyme disease prevalence surveys rely on taking blood samples from dogs.
- Advantages of our technique:
 - Quick and non-invasive
 - Allowed for a large sample size
 - Good geographic spread




 **Acknowledgements**

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