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of Glasgow



Joseph Crispell
crispelljoseph@gmail.com

Evidence of inter-species transmission between cattle and badger populations in Woodchester Park



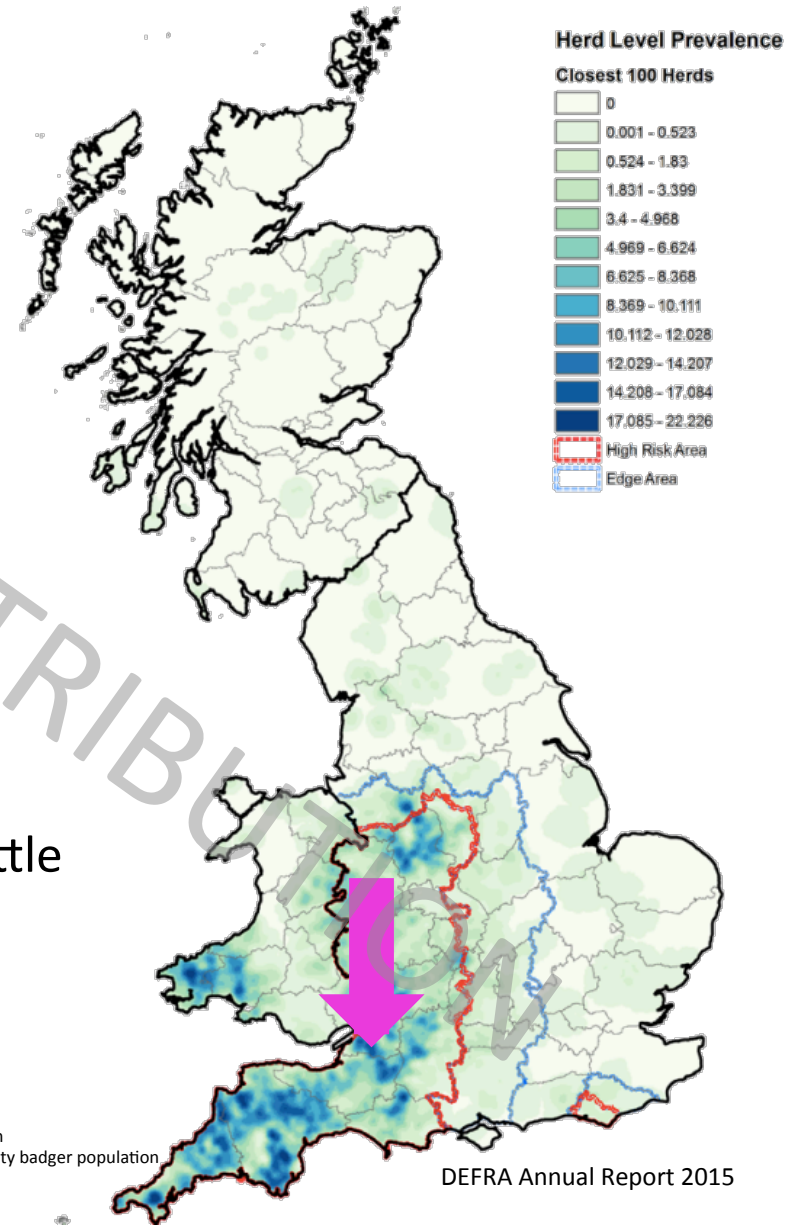
Naturally infected badger population

Badgers trapped every season since late 1970s

Individual badger records of:

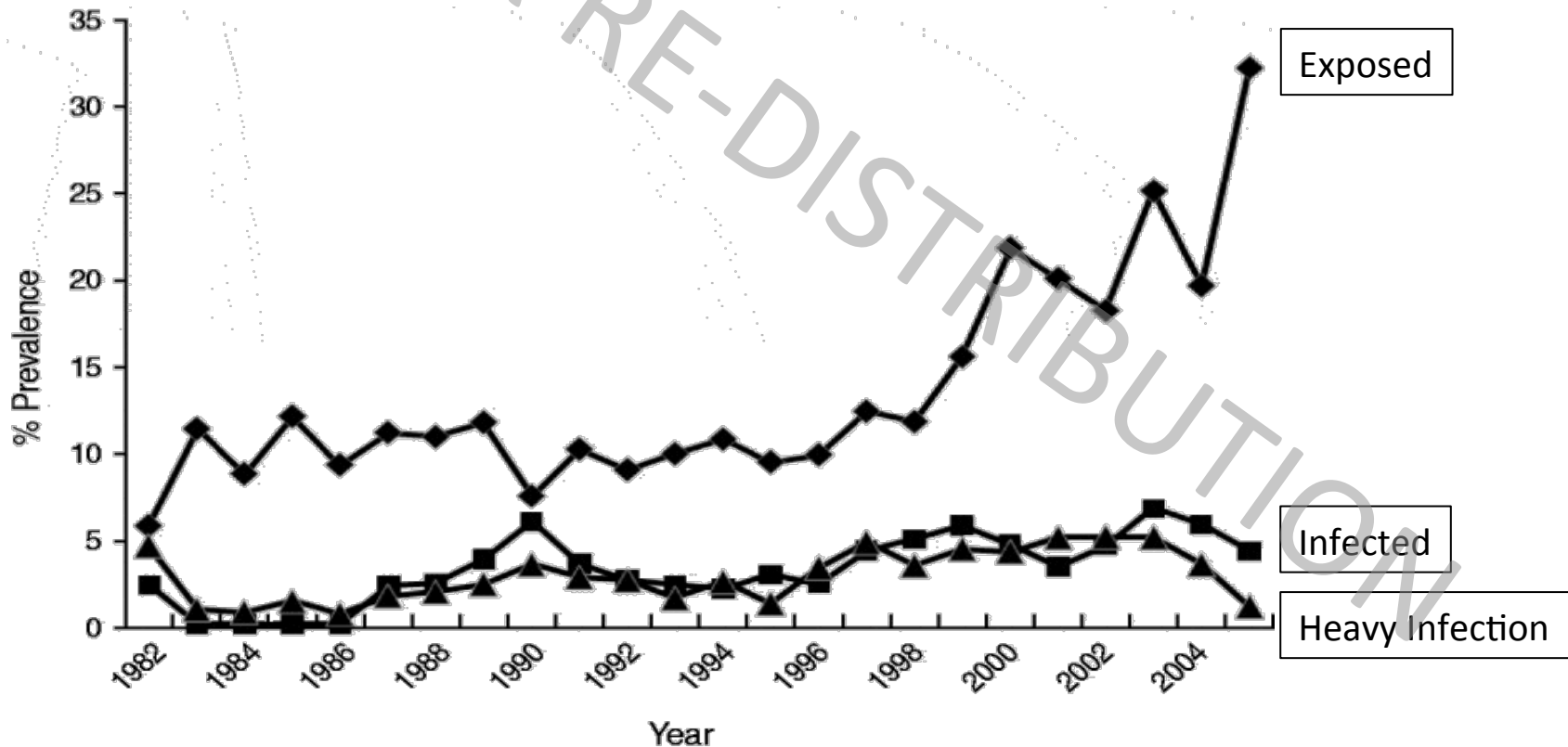
- Infection status
- Trapping locations
- Sex
- Age

High prevalence in badgers and surrounding cattle population



84 Sampled Badgers

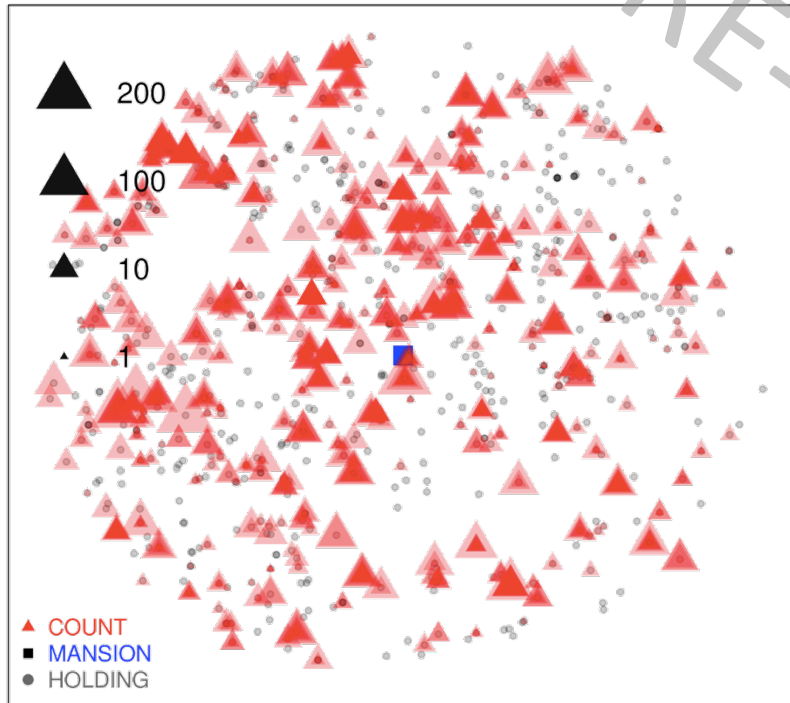
163 Whole Genome Sequenced *M. bovis* isolates



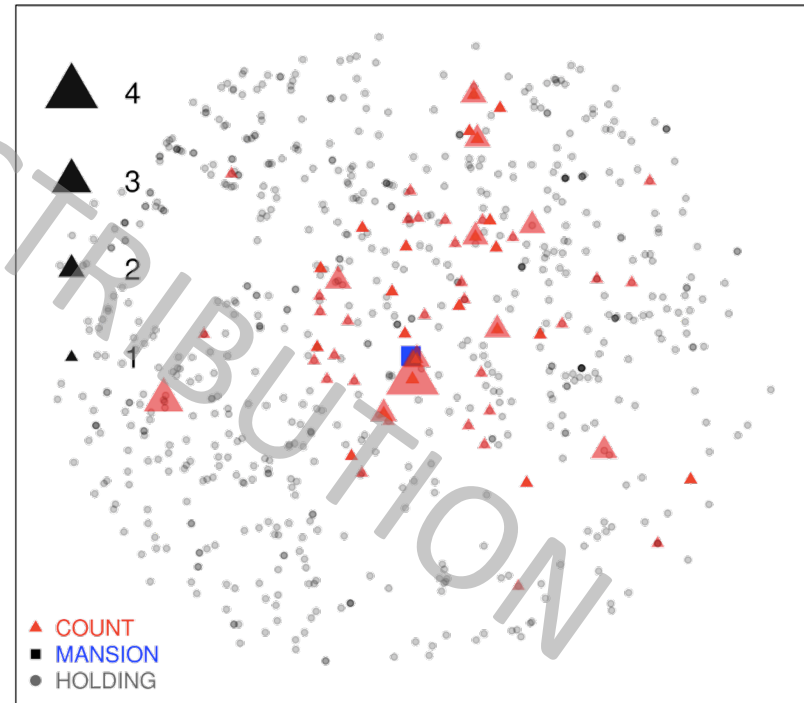


81 Sampled Cattle
81 Whole Genome Sequenced *M. bovis* isolates

Locations of Cattle Reactors



Locations of Sequenced Isolates

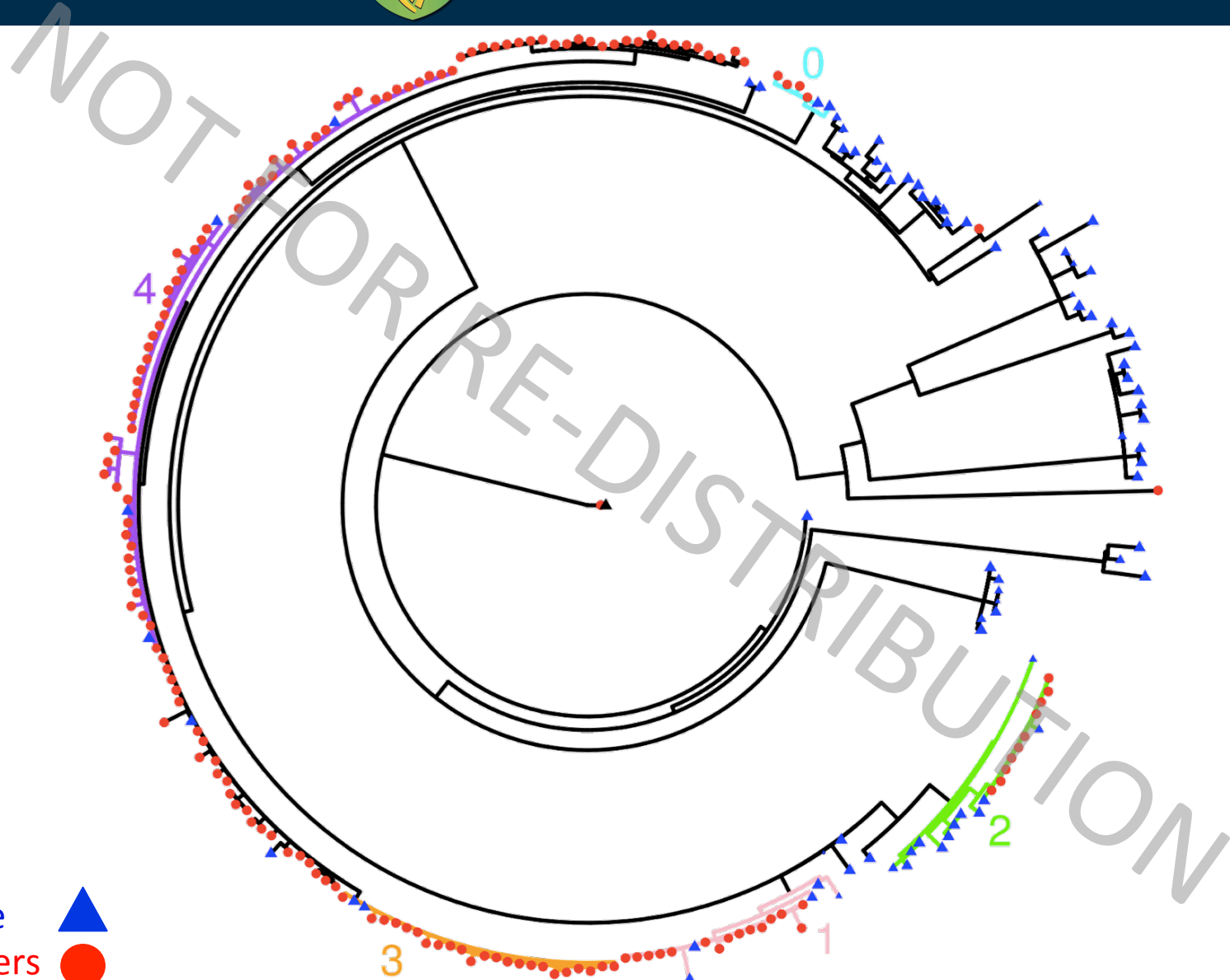


30 km

30 km

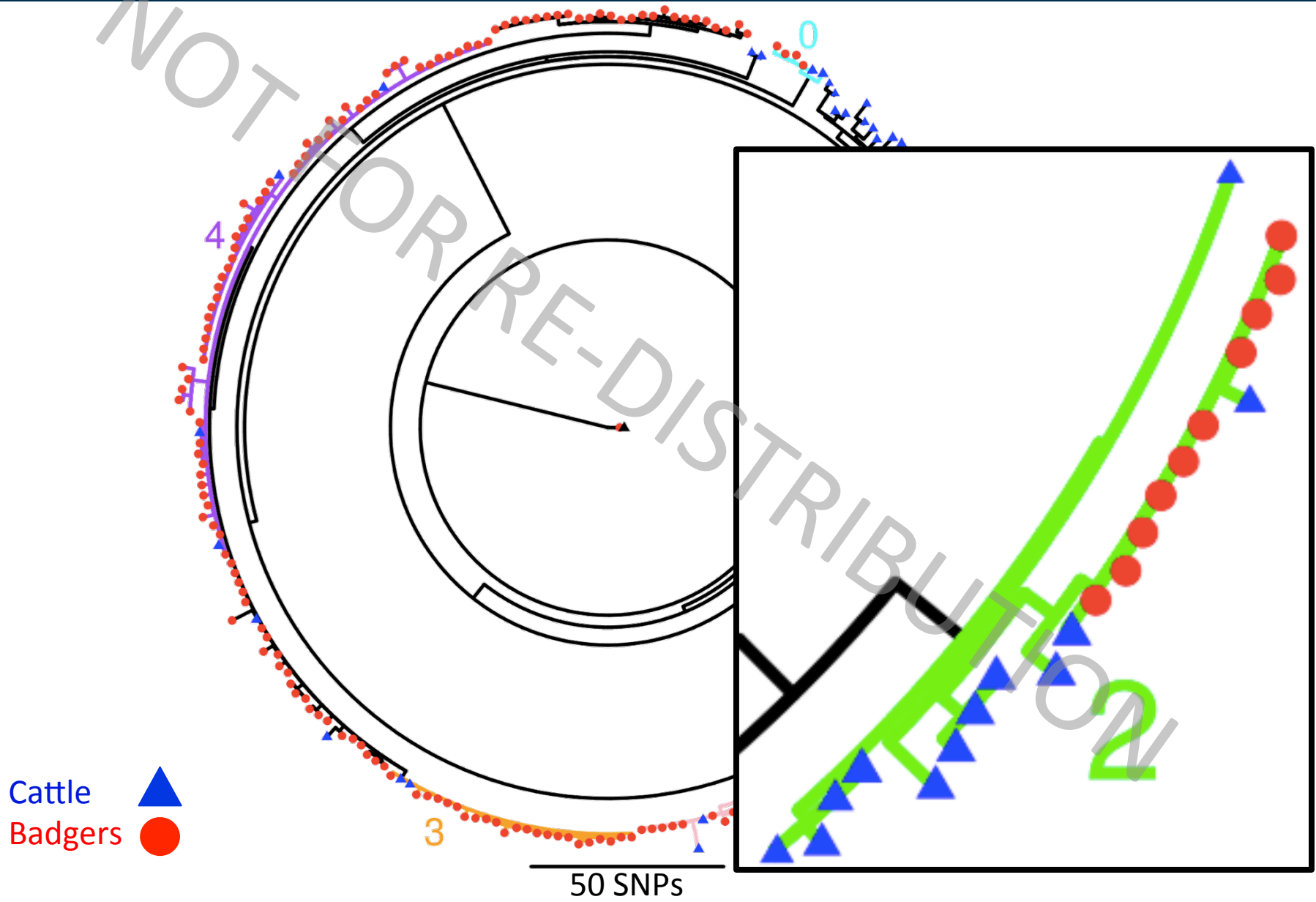


Phylogenetic Tree

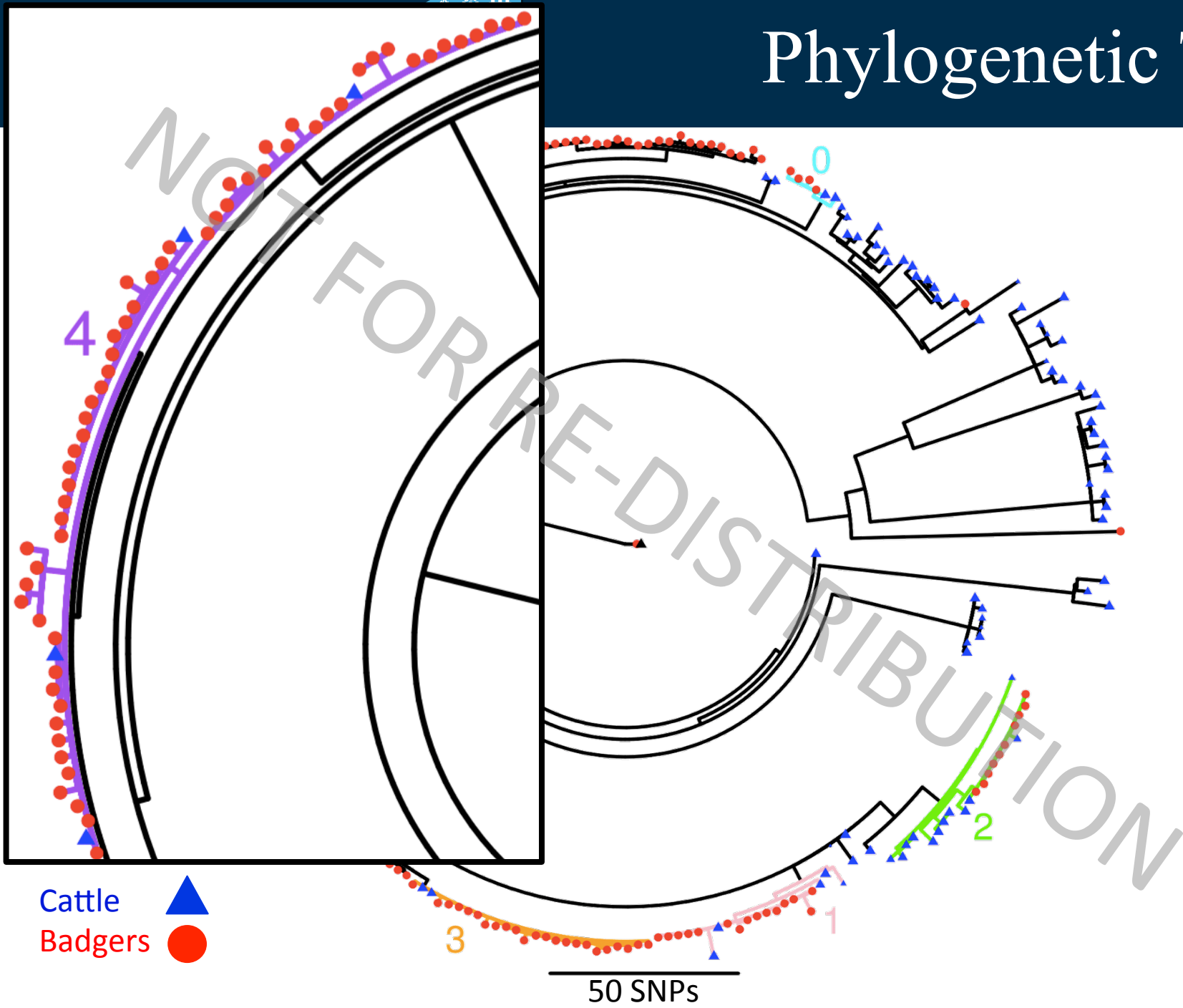


Cattle ▲
Badgers ●

50 SNPs



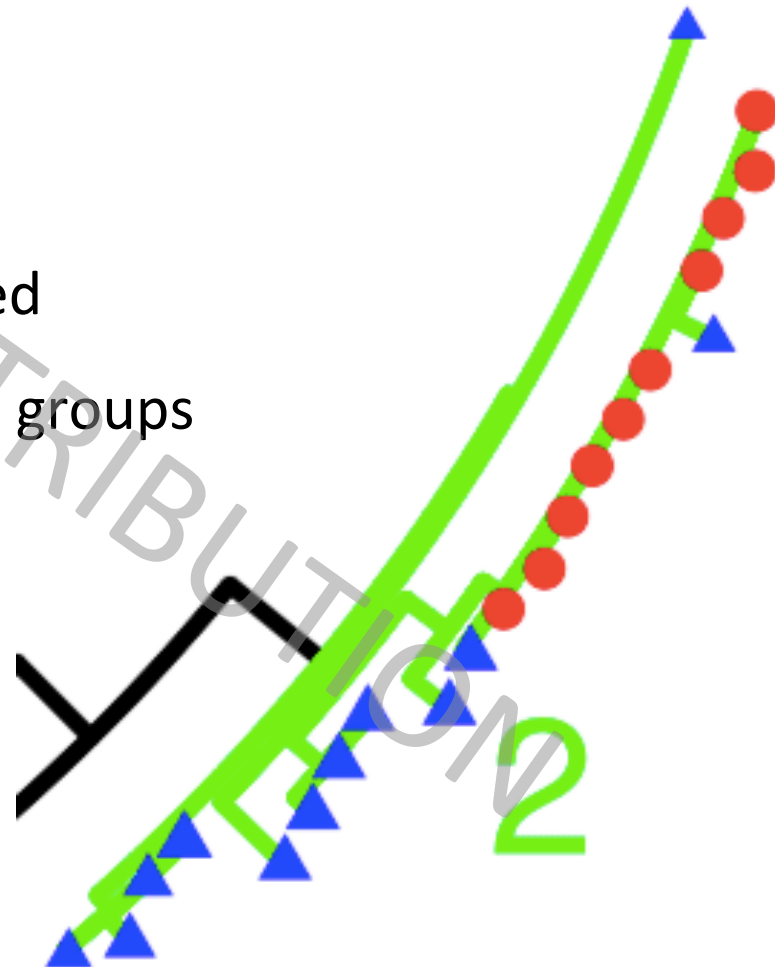
Phylogenetic Tree

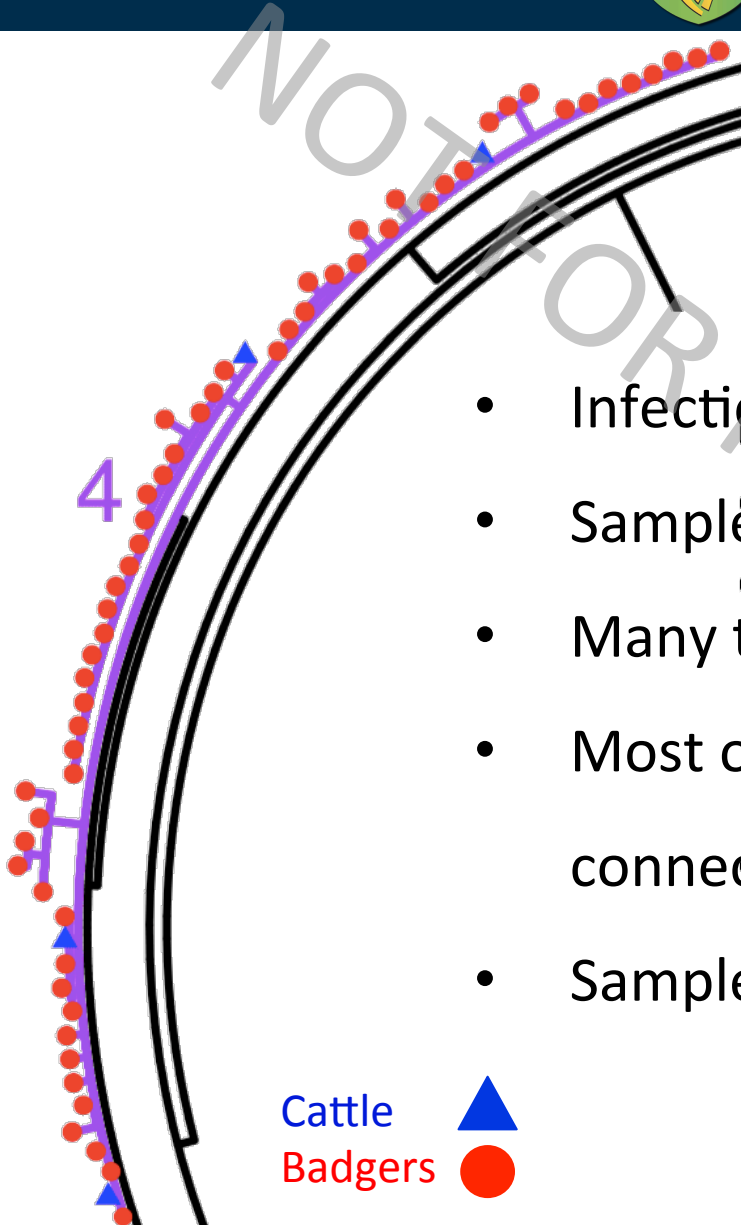




- Infection detected in sampled cattle first
- Many test-positive in-contact cattle
- Cattle isolates closer to clade root
- Majority of 9 sampled herds connected
- 3 unconnected sampled badger social groups

Cattle ▲
Badgers ●

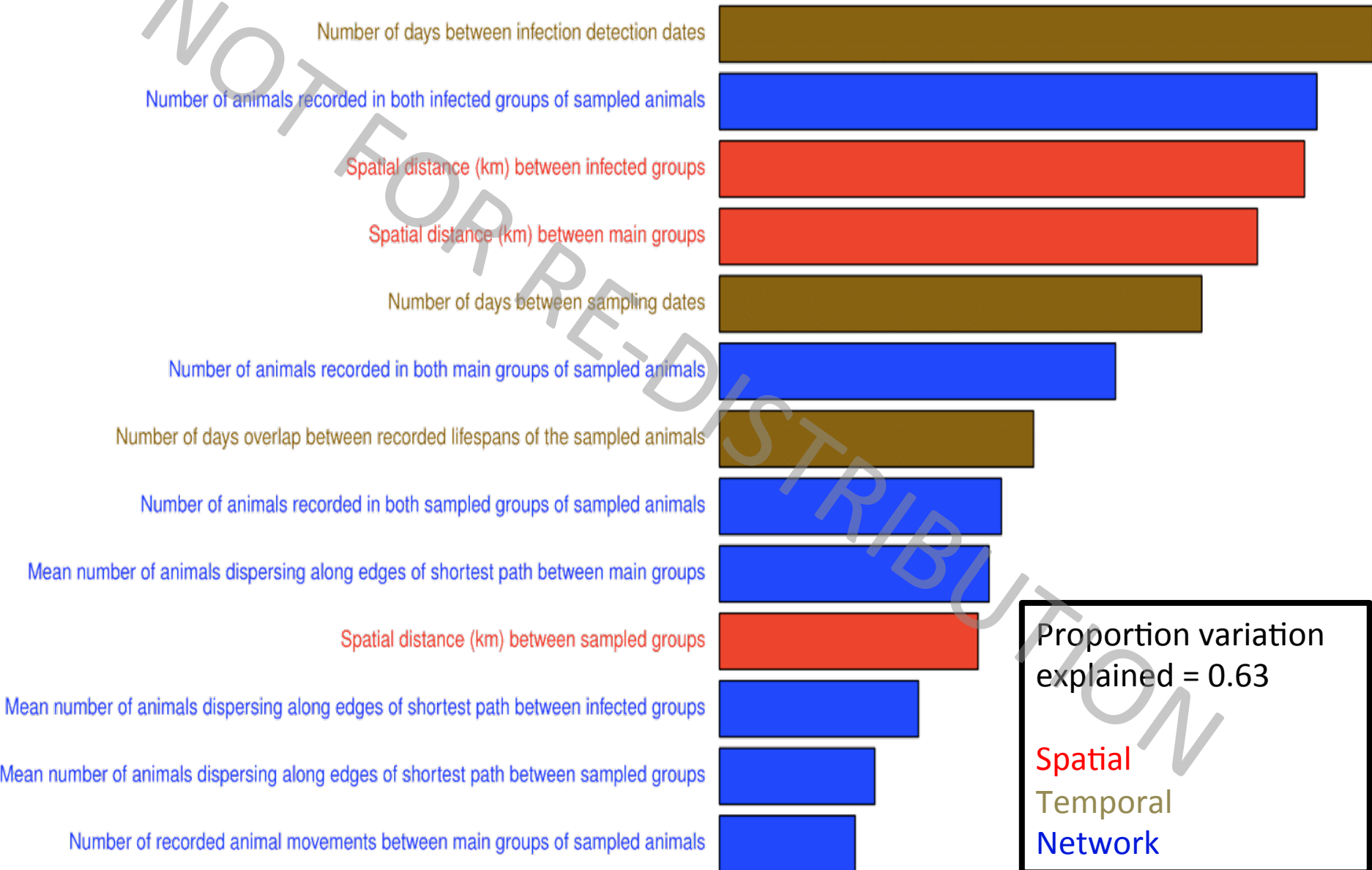




- Infection detected in sampled badgers first
- Sampled herds ~3km from Woodchester Park
- Many test-positive in-contact badgers
- Most of the 17 sampled badger social groups were connected
- Sampled badgers lived >15 years



Comparing Badger Isolates

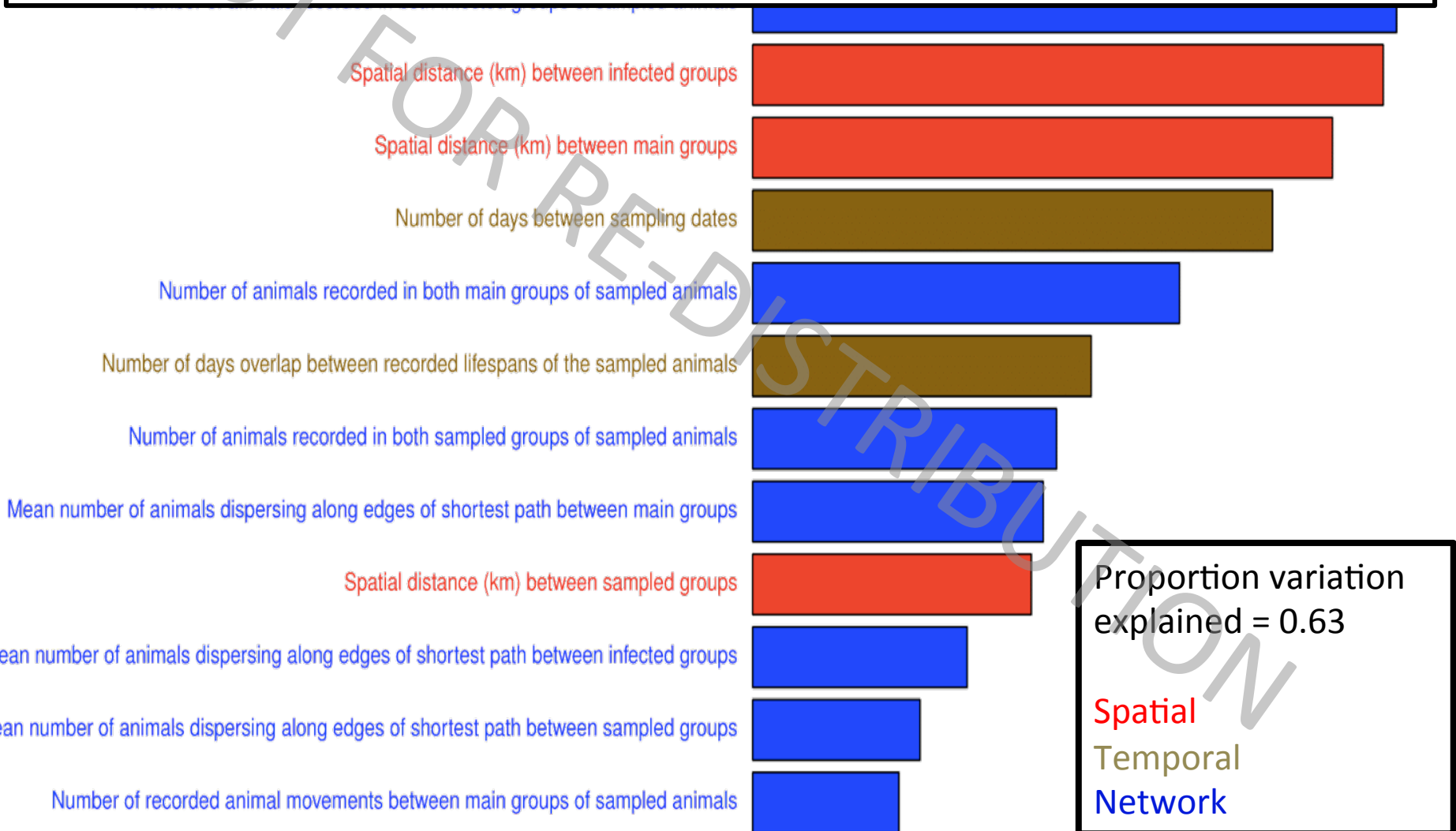


Proportion variation explained = 0.63

Spatial
Temporal
Network



Number of days between infection detection dates



Proportion variation explained = 0.63

Spatial
Temporal
Network



Number of animals that lived in both sampled badger social groups

Number of days between infection detection dates

Spatial distance (km) between main groups

Number of days between sampling dates

Number of animals recorded in both main groups of sampled animals

Number of days overlap between recorded lifespans of the sampled animals

Number of animals recorded in both sampled groups of sampled animals

Mean number of animals dispersing along edges of shortest path between main groups

Spatial distance (km) between sampled groups

Mean number of animals dispersing along edges of shortest path between infected groups

Mean number of animals dispersing along edges of shortest path between sampled groups

Number of recorded animal movements between main groups of sampled animals

Proportion variation explained = 0.63

Spatial

Temporal

Network



Comparing Badger Isolates

Number of days between infection detection dates



Number of animals recorded in both infected groups of sampled animals



Spatial distance (km) between the sampled badger social groups

Number of days between sampling dates



Number of animals recorded in both main groups of sampled animals



Number of days overlap between recorded lifespans of the sampled animals



Number of animals recorded in both sampled groups of sampled animals



Mean number of animals dispersing along edges of shortest path between main groups



Spatial distance (km) between sampled groups



Proportion variation explained = 0.63

Spatial

Temporal

Network

Mean number of animals dispersing along edges of shortest path between infected groups



Mean number of animals dispersing along edges of shortest path between sampled groups

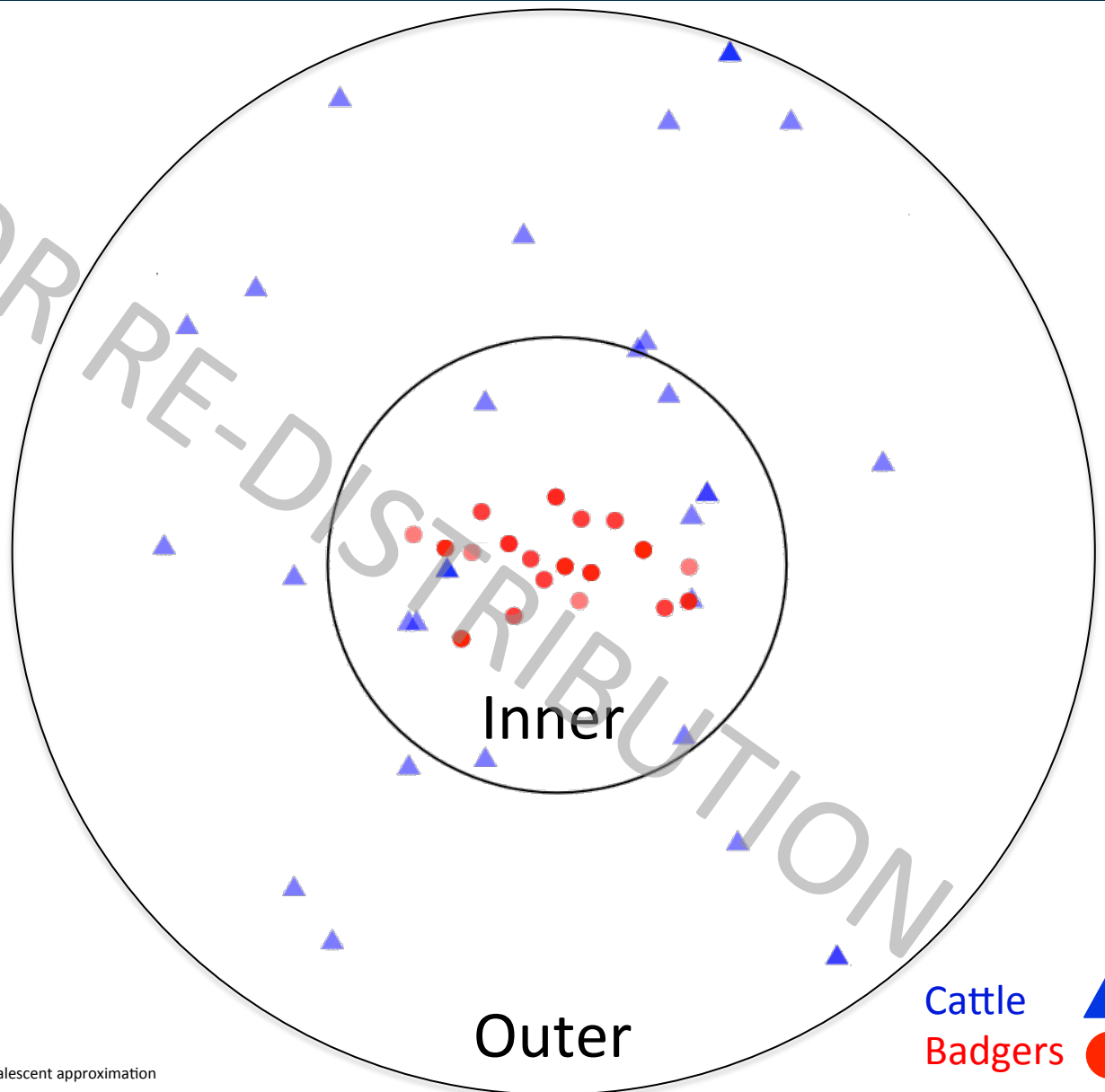


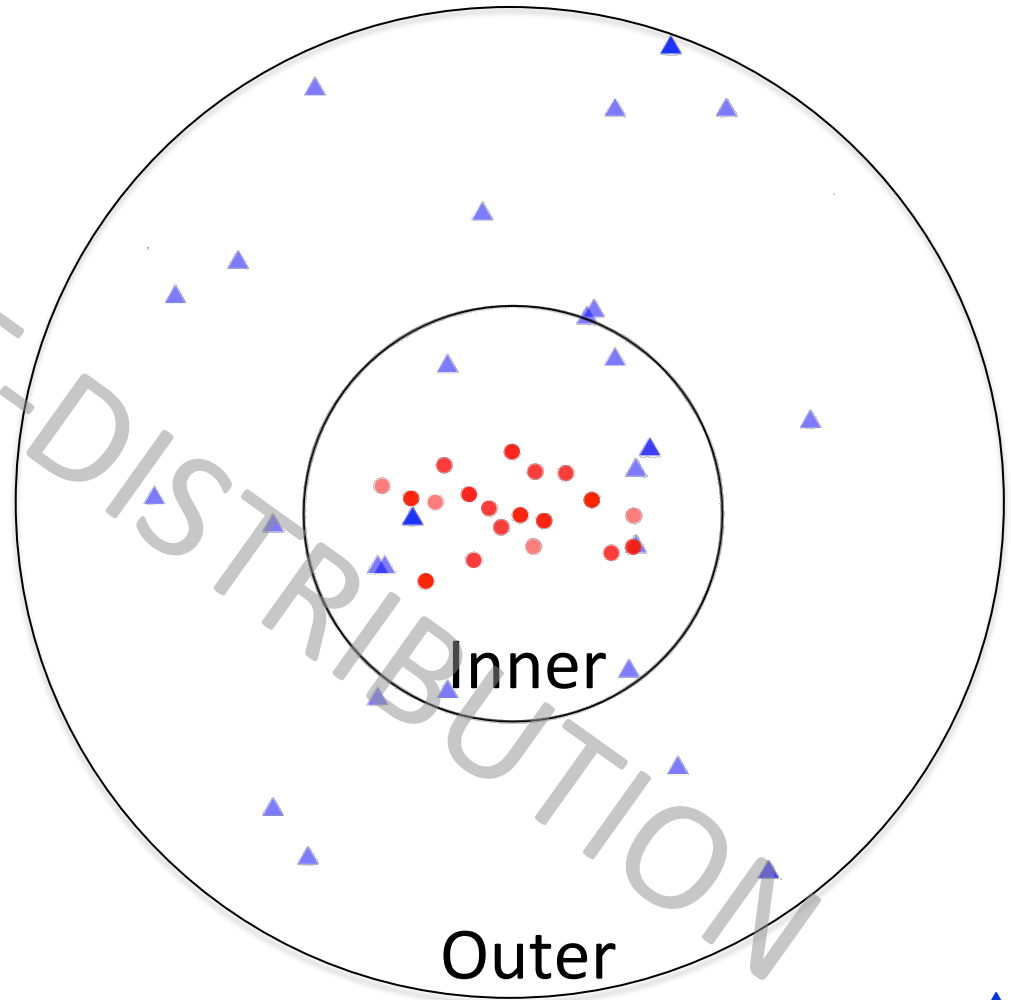
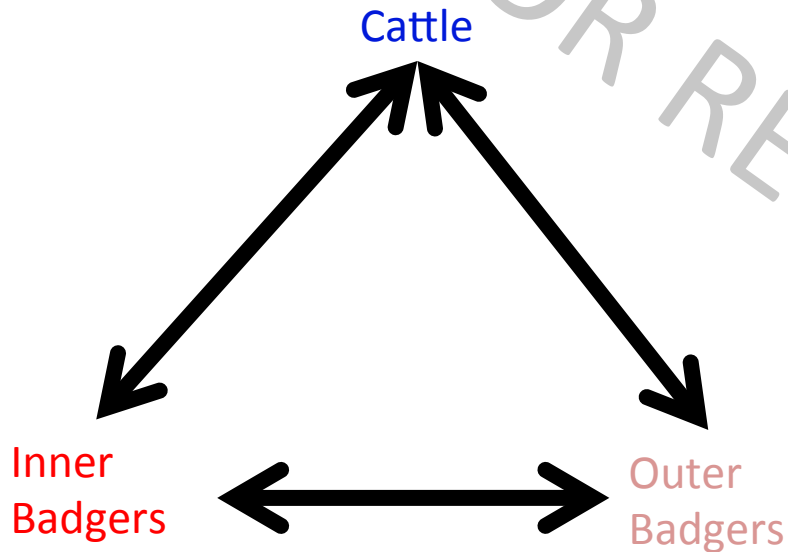
Number of recorded animal movements between main groups of sampled animals



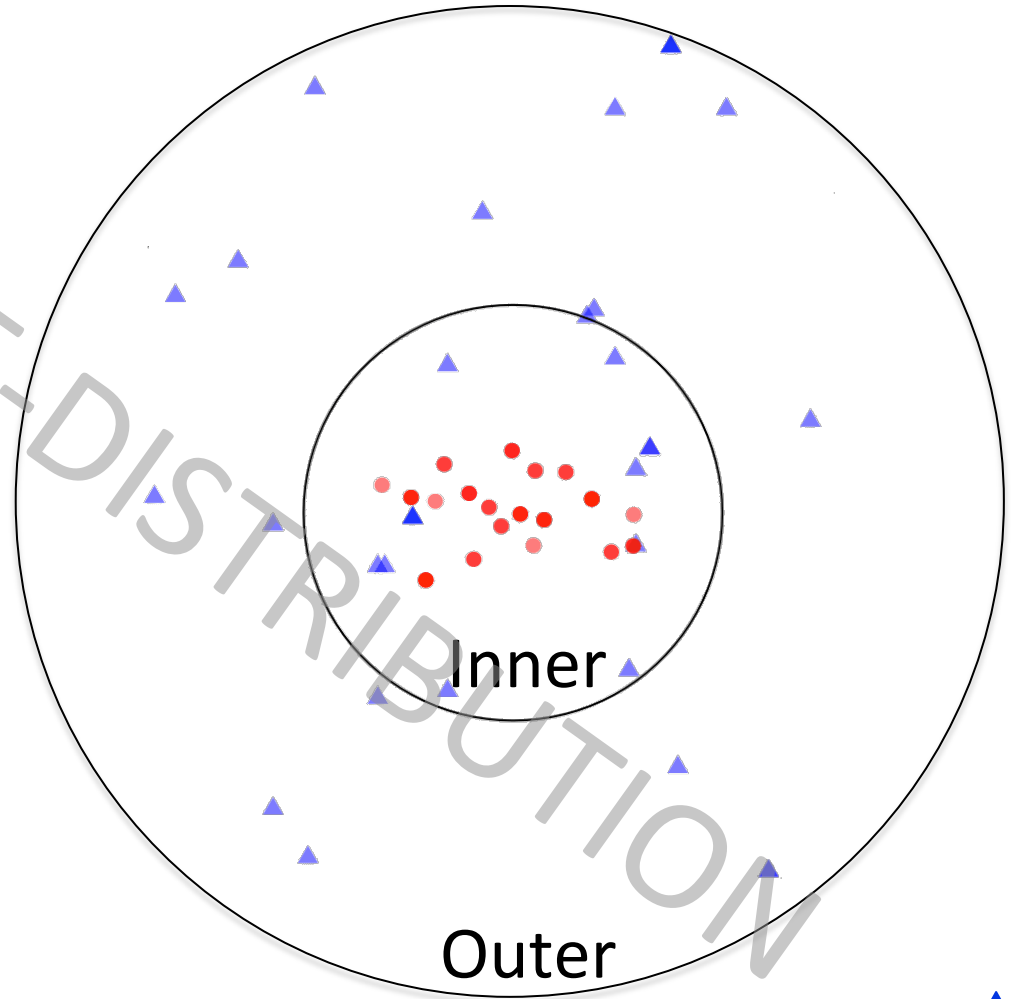
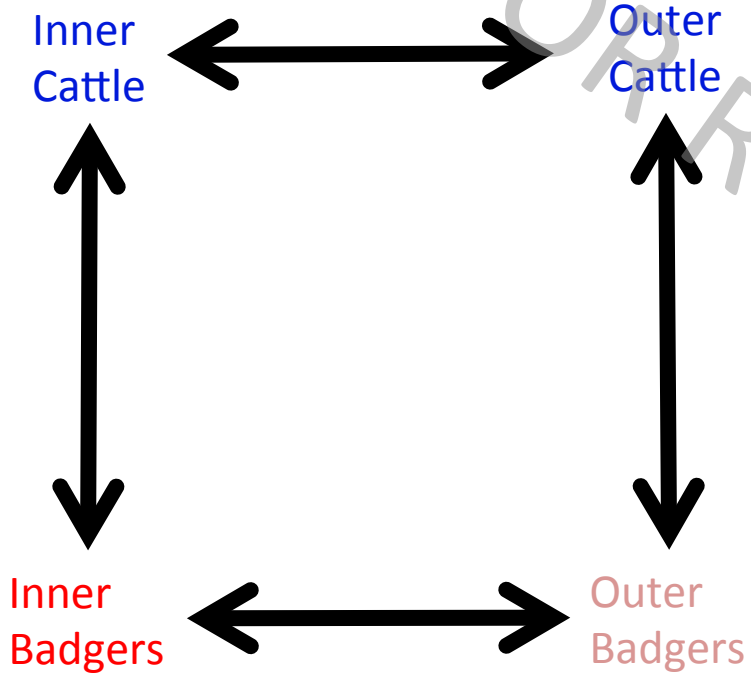


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Approximation

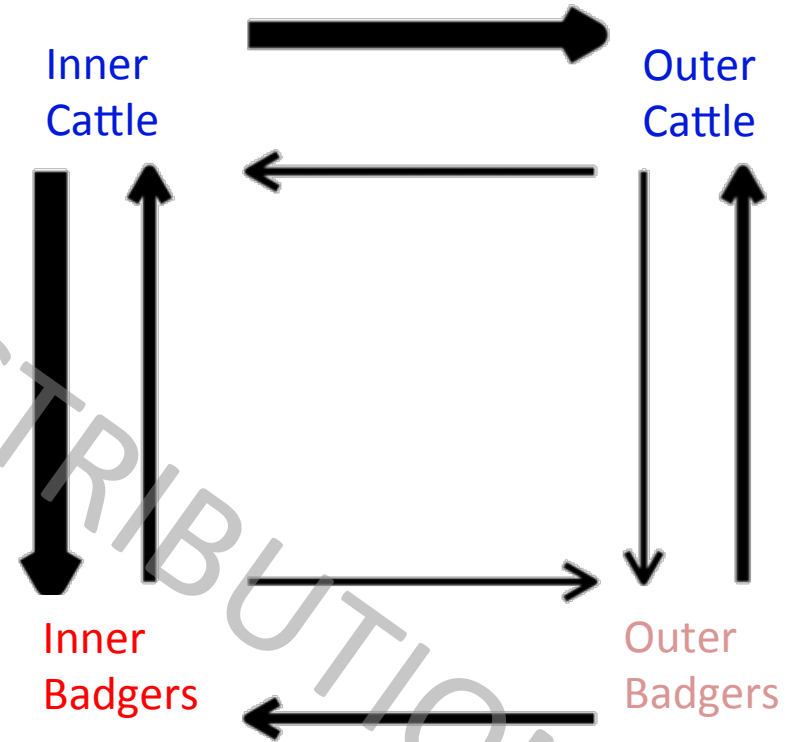
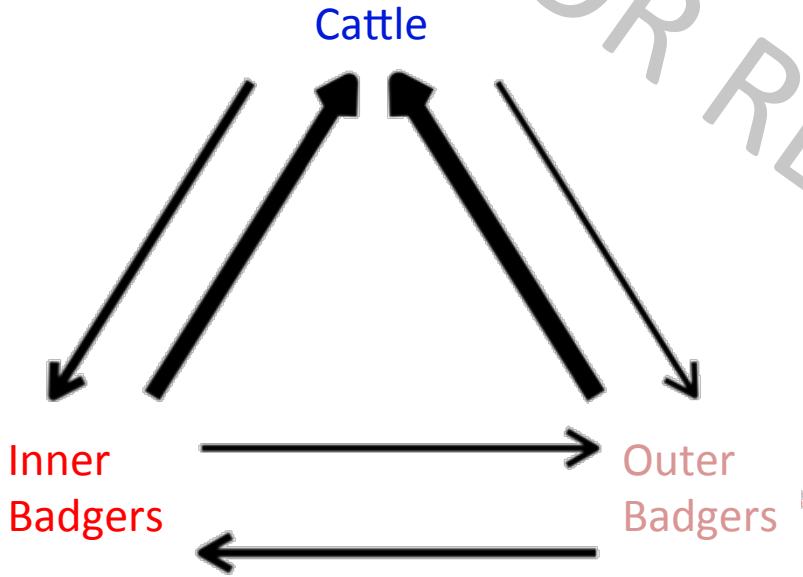




Cattle 
Badgers 



Cattle 
Badgers 





Sampled badger population maintained infection independently

Evidence of inter-species transmission in both directions



University of Glasgow



THANKS!!!!!!

Rowland Kao

Ruth Zadoks

Stephen Gordon

Noel Smith



Department for Environment Food and Rural Affairs

Clare Benton

Javier Nunez

Daniel Wilson

James Dale

Nicola Di Maio



Paddy Brock

Dez Delahay

Colette Mair

Assell Akhmetova

Paul Johnson

Nicola Kerbyson

Daniel Balaz

Liliana Salvador

Roman Biek

Michael Deason

Thomas Doherty

Joanna Crispell

Hannah Trewby

Sibylle Mohr

Samantha Lycett

Theo Pepler

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