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# Applying *Salmonella* vaccination at the top of a UK pig production pyramid

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# *Salmonella* Typhimurium

- Zoonotic pathogen with many animal hosts, causing diarrhoea and septicaemia.
- Second most common cause of foodborne illness (after *Campylobacter)* in the EU
- EU member states reported 91,662 human cases in 2017 (EFSA)

- Also cause of economic losses to the pig industry, causing enteritis, and occasionally septicaemia, especially in weaners
- Infections can be clinically silent, but with intermittent shedding, increasing at times of stress

- Monophasic *S.* Typhimurium has rapidly emerged over the last 2 decades and is now one of the most prevalent serovars in human cases
- In 2017, 28.3% of *S.* Typhimurium and 49.7% of monophasic *S.* Typhimurium cases in humans were associated with pig sources

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# Monophasic *Salmonella* Typhimurium

- "Monophasic" refers to expression of the flagellar (H) antigens
- *Salmonella* are normally bi-phasic, and switch between expression of two types of flagellin

"Classical" Typhimurium

Antigenic formula: 1,4,[5],12:i:1,2

- 1,4,[5],12 — Somatic (O) antigens
- i — Phase 1 H antigen
- 1,2 — Phase 2 H antigens

Monophasic Typhimurium

4,5,12:i:-

4,12:i:-

1,4,[5],12:i:-

4,[5],12:-:1,2

- Monophasic variants are equally pathogenic
- European clades exhibit resistance to multiple antimicrobials

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# Can vaccination aid *Salmonella* control throughout a pig production pyramid?

- *Salmonella* can be introduced to a farm in many ways, but infected pig movement is most common
- Sows, gilts and piglets on a multiplier farm were vaccinated with a live, commercial *S.* Typhimurium vaccine, according to the schedule provided by the manufacturer

## Vaccination schedule

| | Basic immunisation | Booster vaccination |
|---|---|---|
| Sows | Two subcutaneous injections with a 3-week interval (6 and 3 weeks before farrowing) | 1 injection (3 weeks before farrowing) |
| Piglets | 2 oral vaccinations with a 3-week interval (starting on day 3 after birth) | |

Immunity develops within 2 weeks of completing the vaccination course.

Duration of immunity:

in sows 24 weeks,

in fatteners 19 weeks

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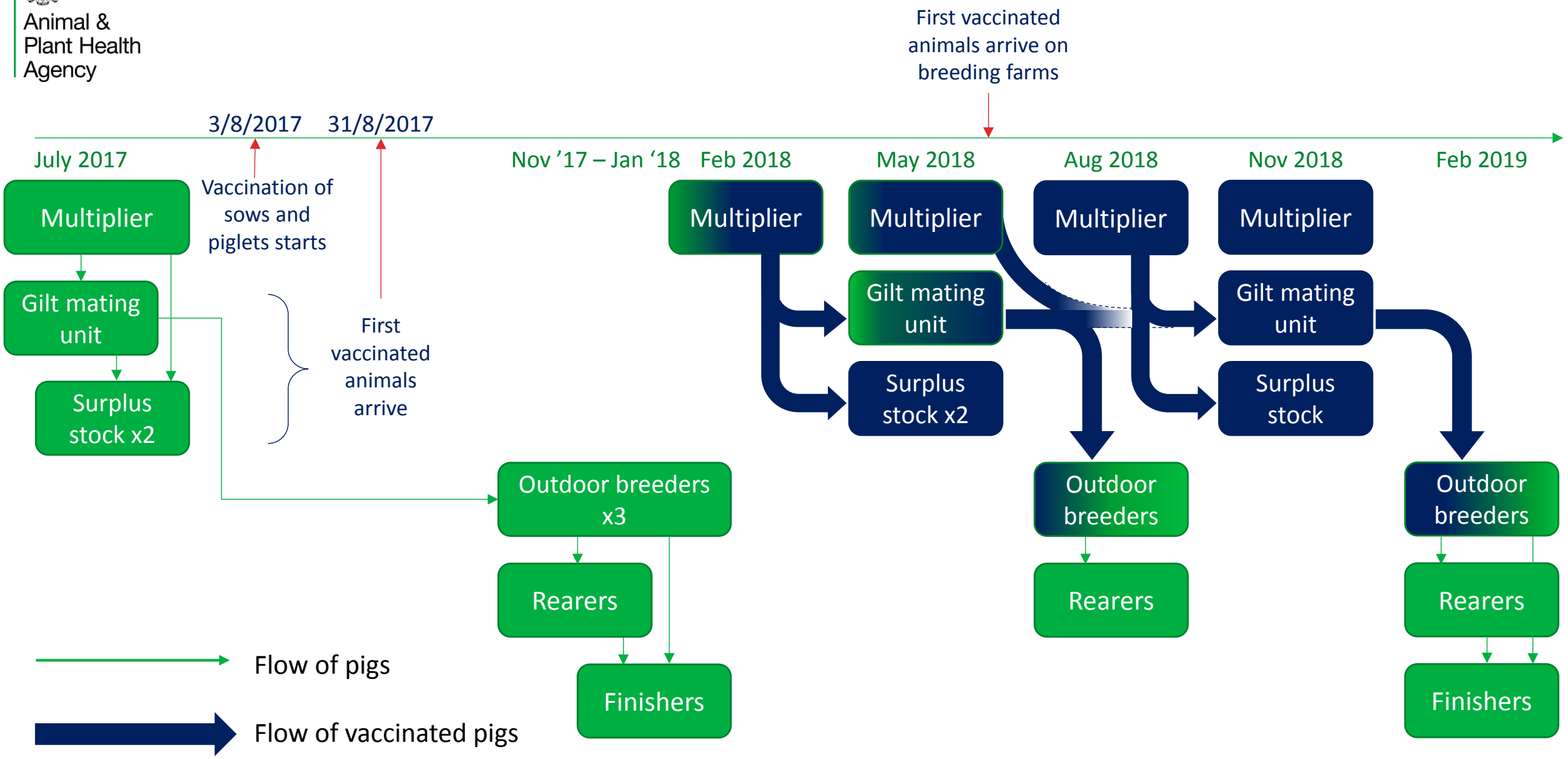

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# Field sample collection

Multiplier and gilt mating unit:

- Pooled faecal samples from every pen
- 60 individual faecal samples from every pig stage

Other units

- Samples collected from every building (indoor) or every paddock (outdoor) and every pig stage (farrowing sows, dry sows, pregnant gilts, weaners, finishers)
- Up to 60 pooled and 60 individual per pig production stage, distributed evenly between all enclosures

Samples from environment (eg. standing water, bird faeces) and swabs from farm equipment also collected on all farms

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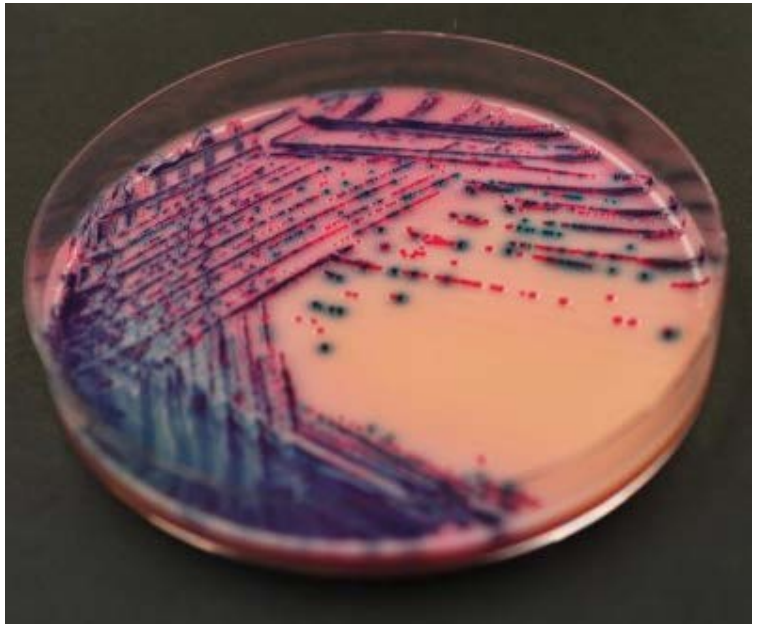
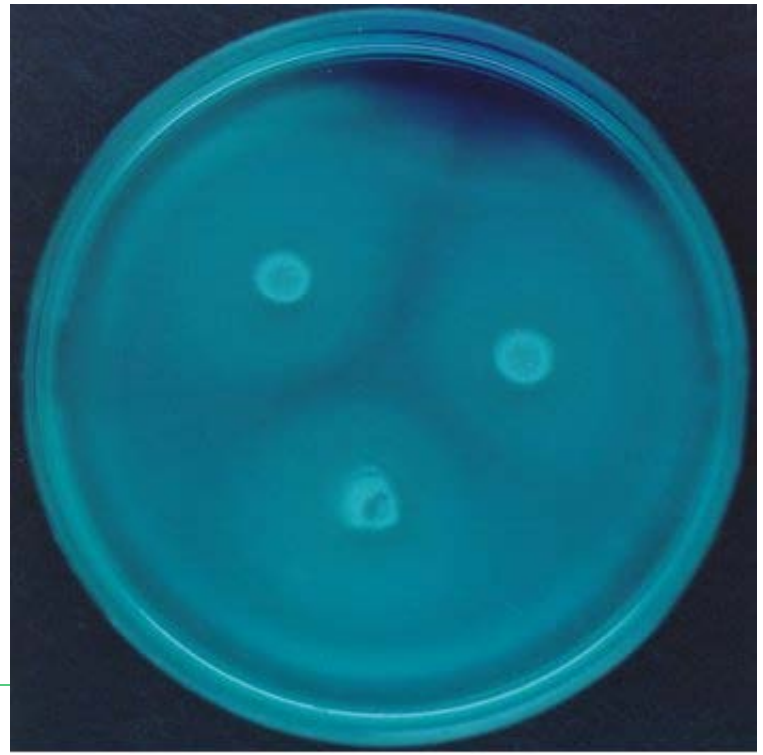
# Laboratory procedures

- Buffered peptone water, MSRV and Rambach agar method
- Positive cultures were serotyped

- Classical *S.* Typhimurium isolates from the multiplier, gilt mating unit and surplus finisher units were tested to differentiate vaccine strain from wild-type

- Quantification of positive individual samples was carried out using serial dilutions and culture on MSRV and Rambach agar
- Pooled samples are more sensitive for detection, whereas individual samples give a better indication of animal-level prevalence and burden.





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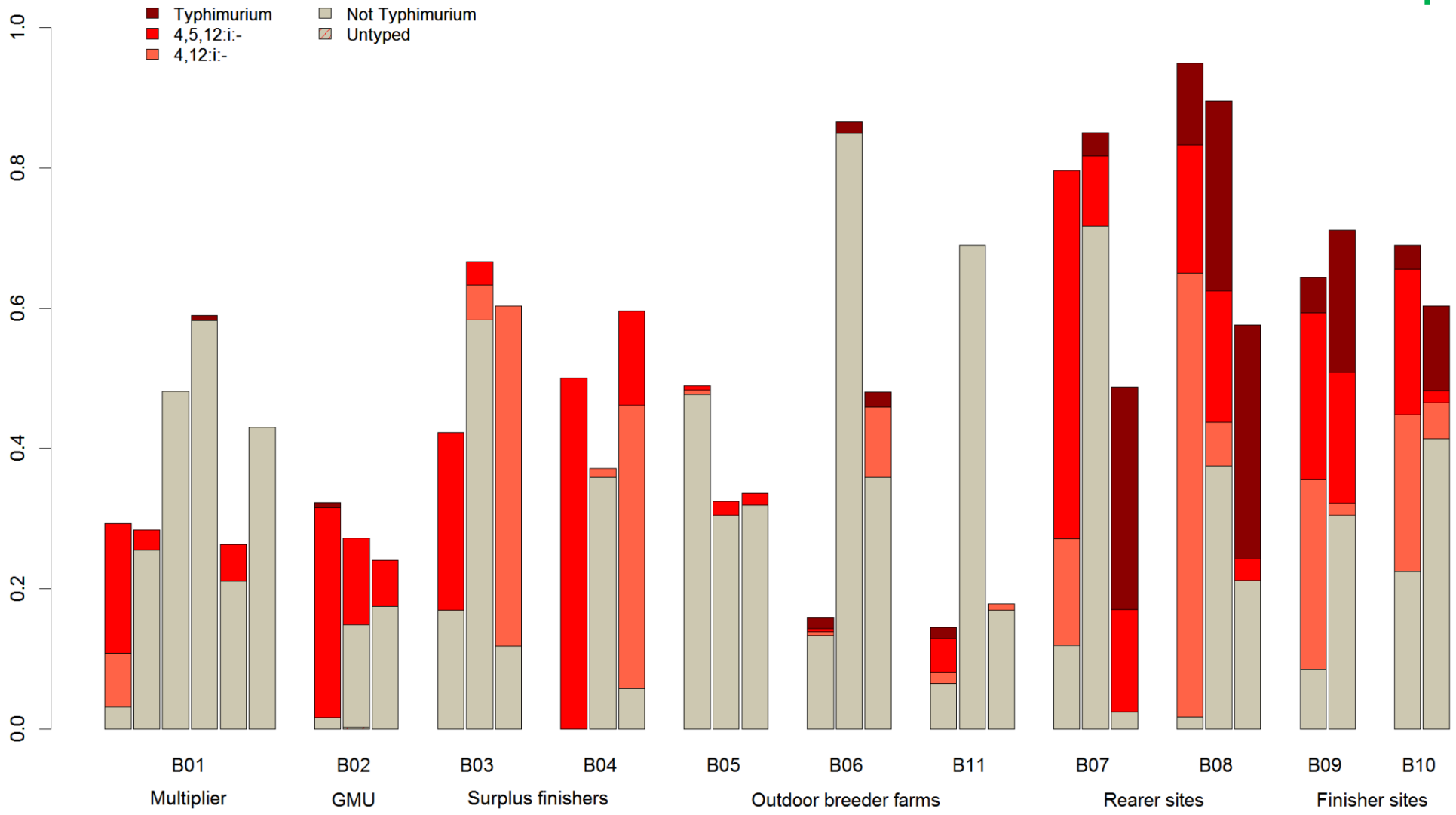
# Pooled samples



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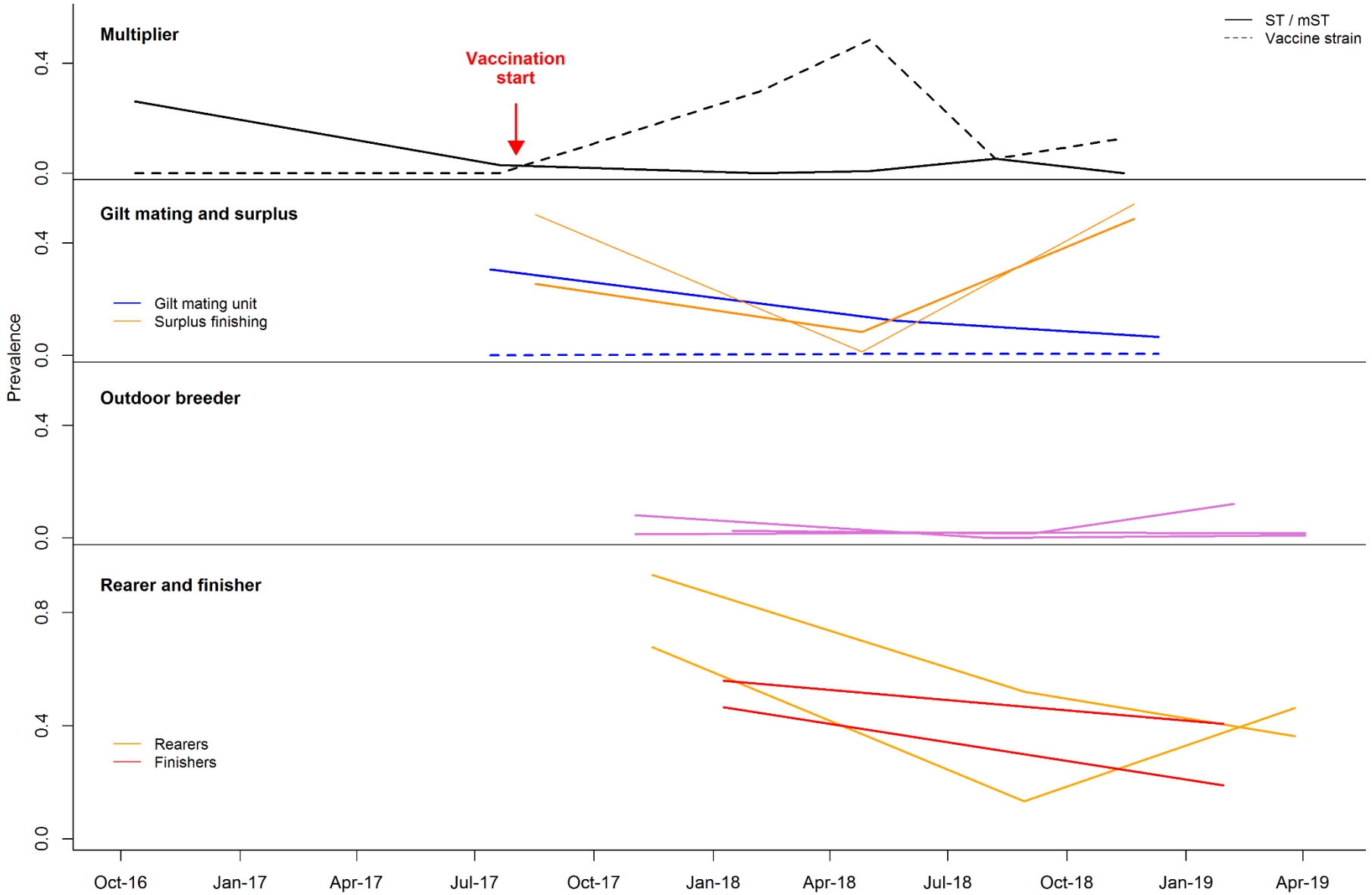

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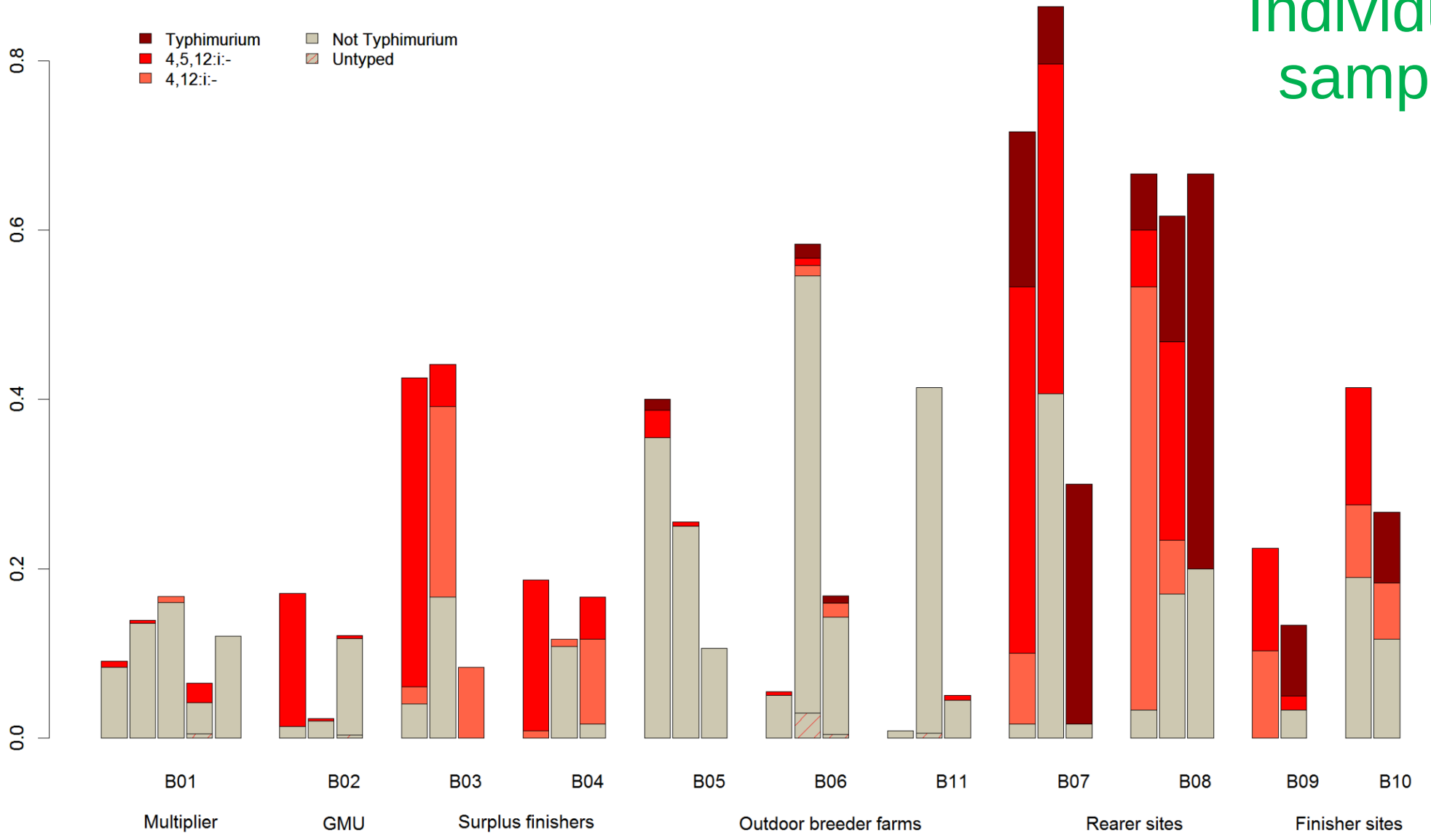
# Individual samples



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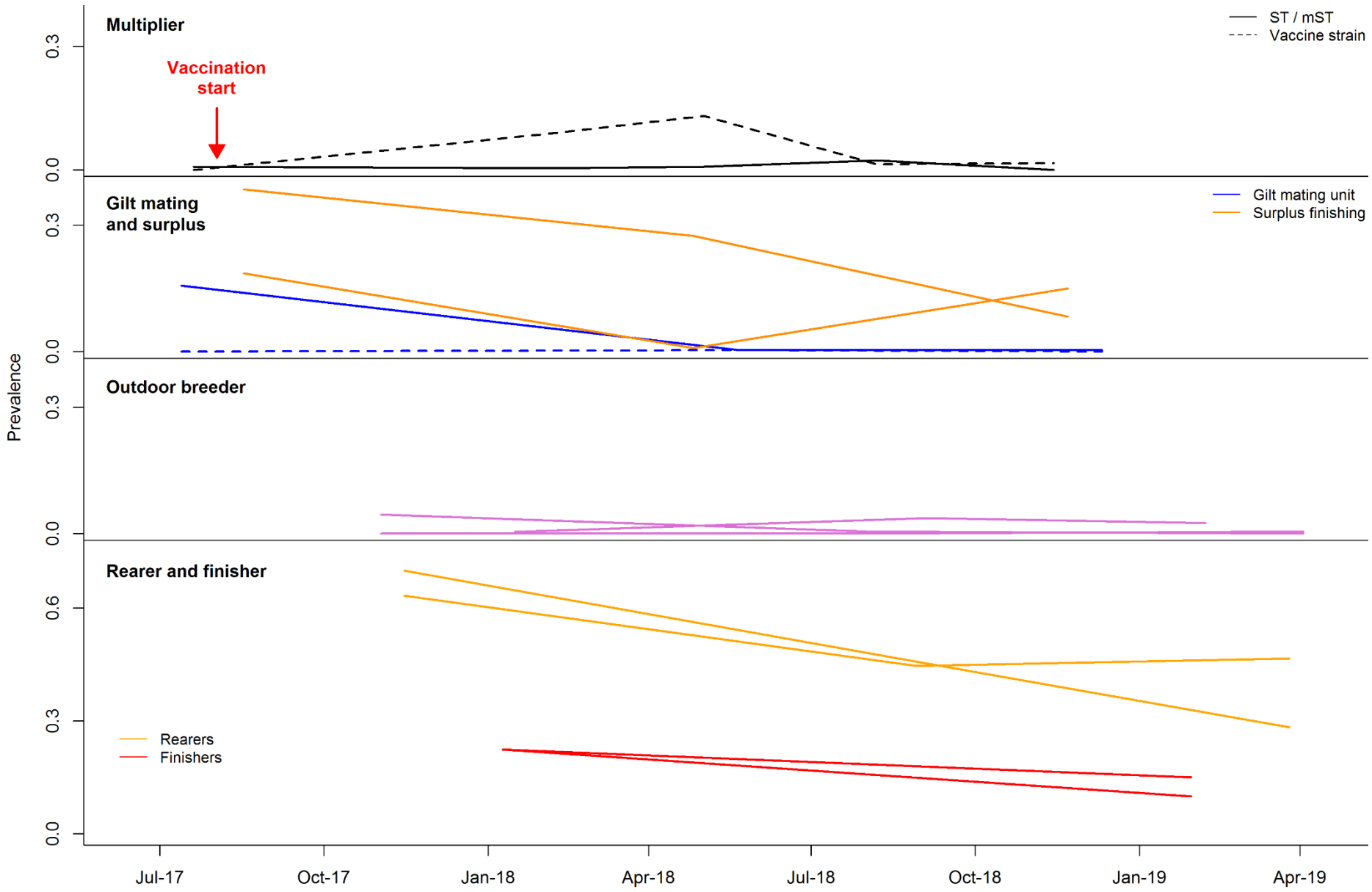

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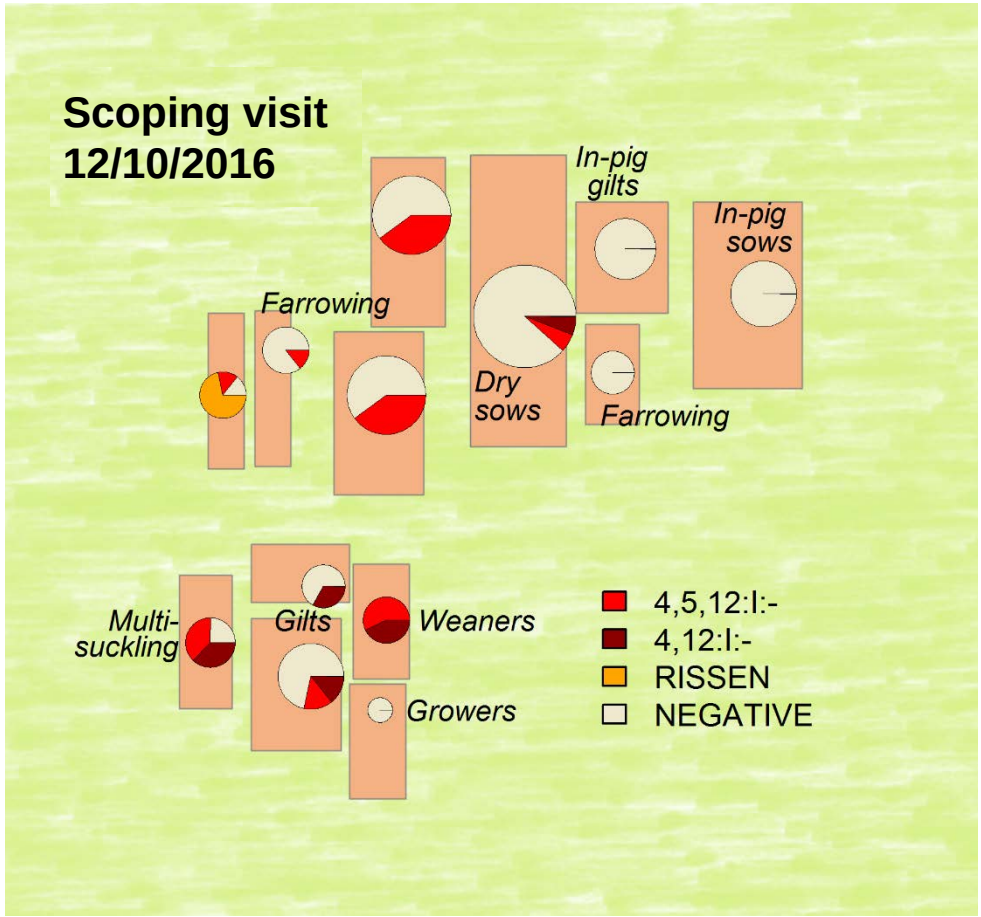
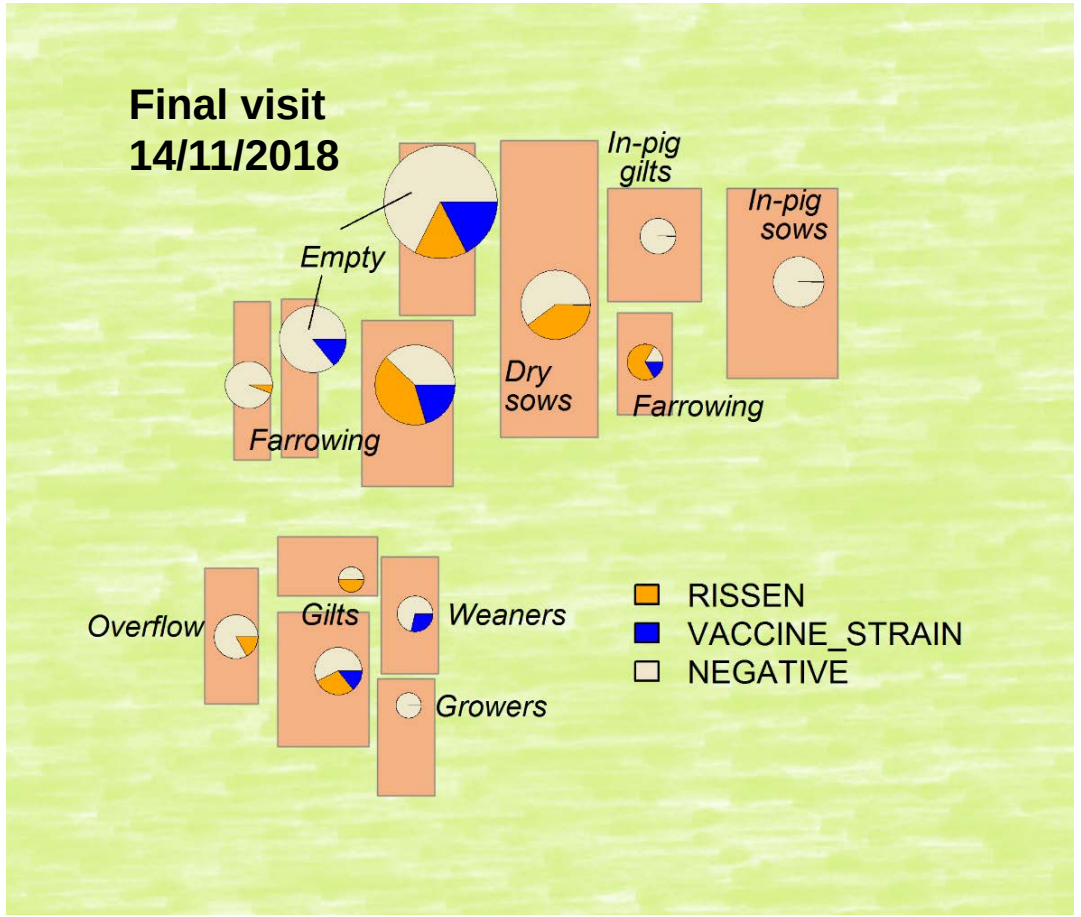
# Multiplier farm – sow and piglet vaccination



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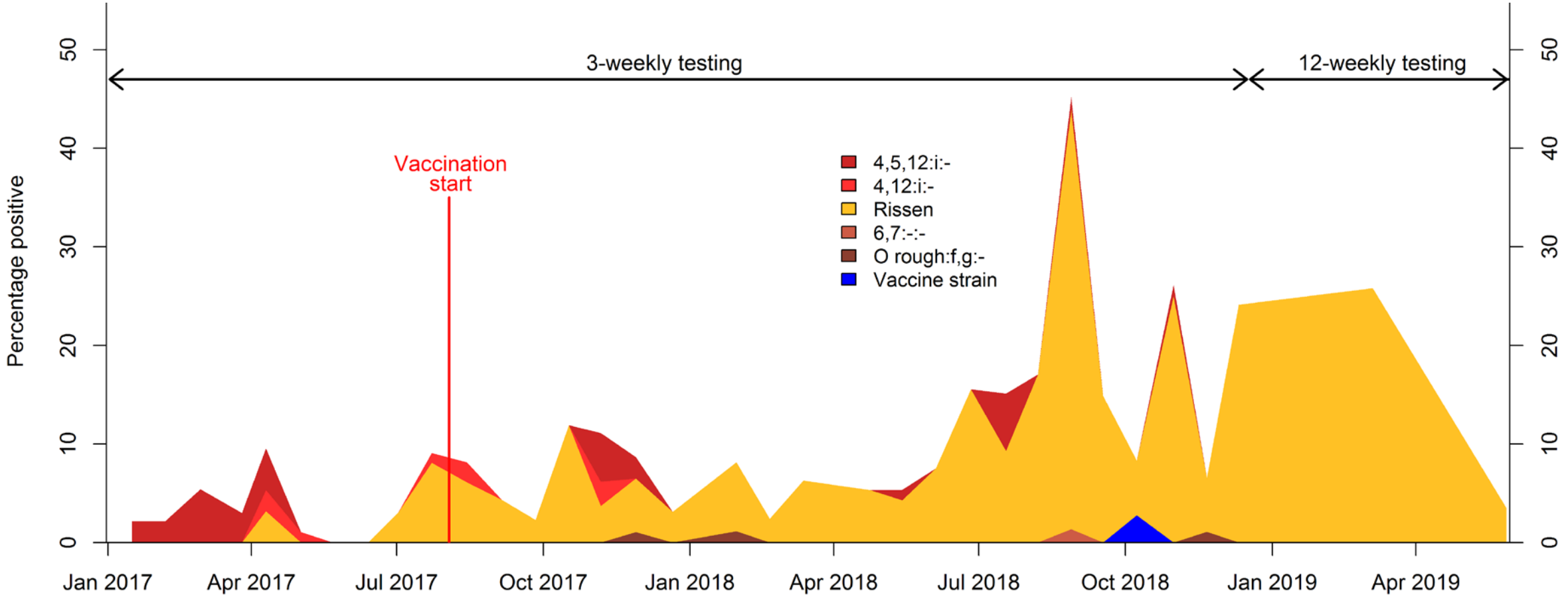
# Individual testing of sows pre-farrowing



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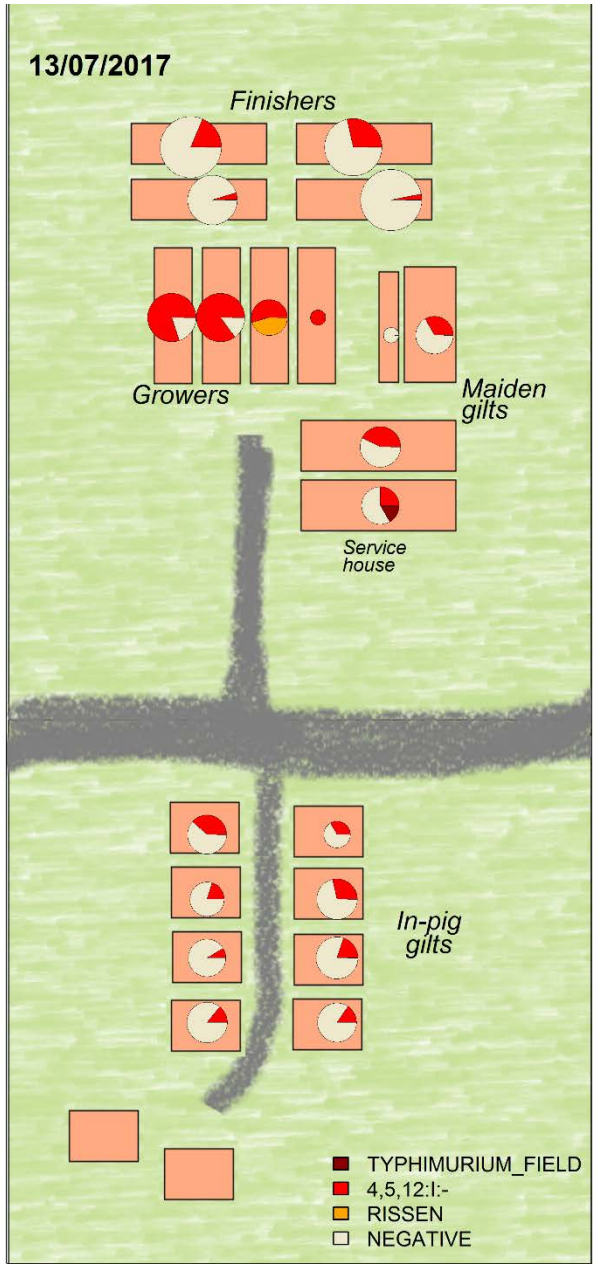
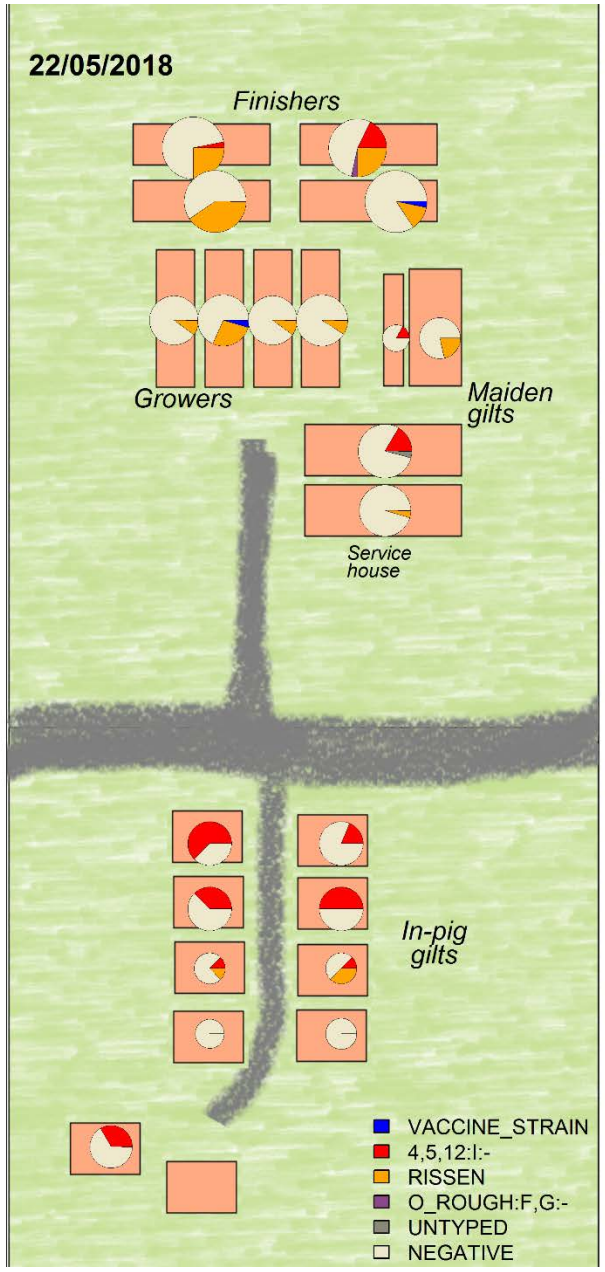
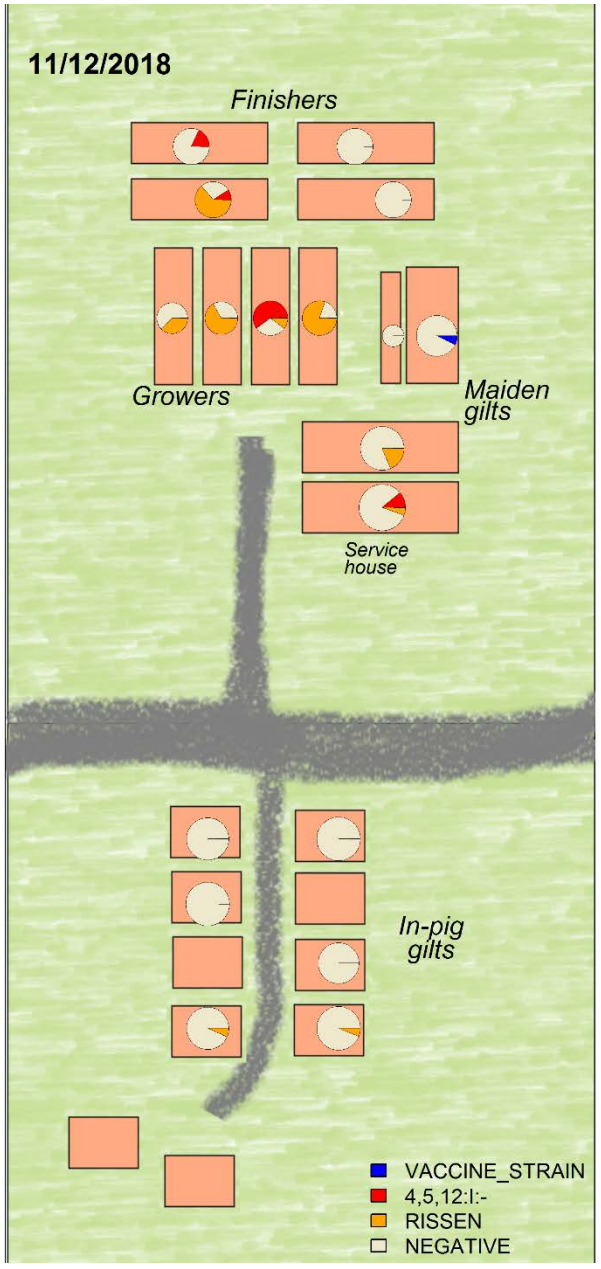
# Gilt mating unit



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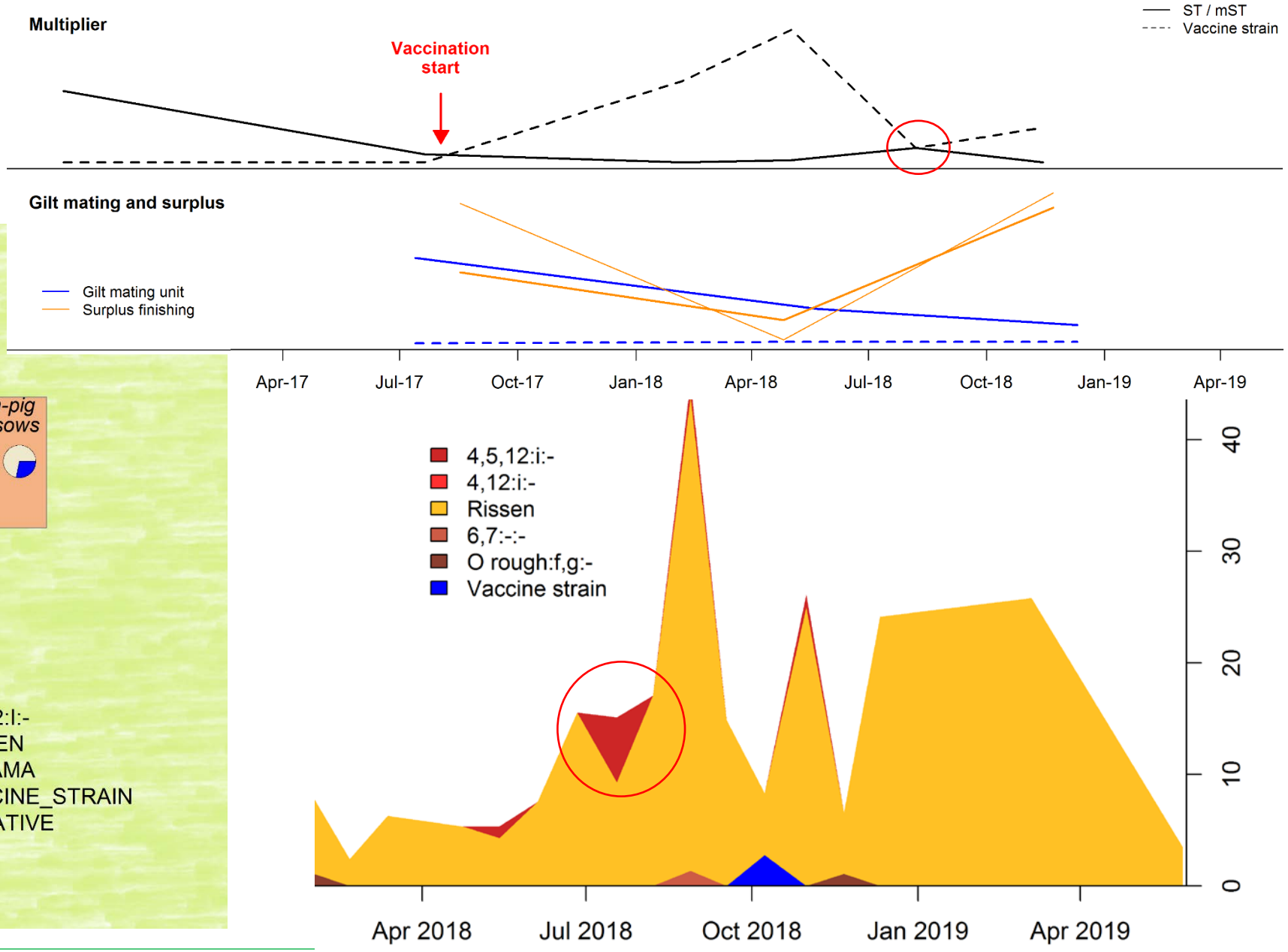


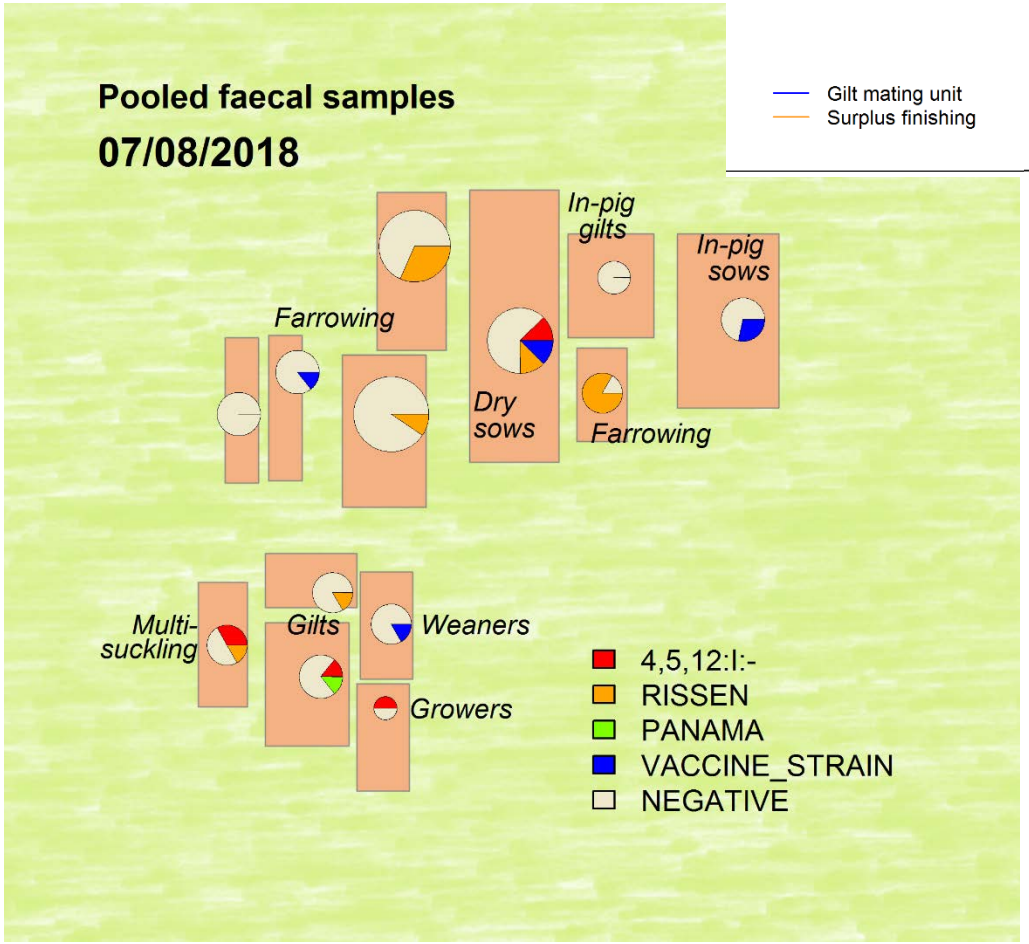

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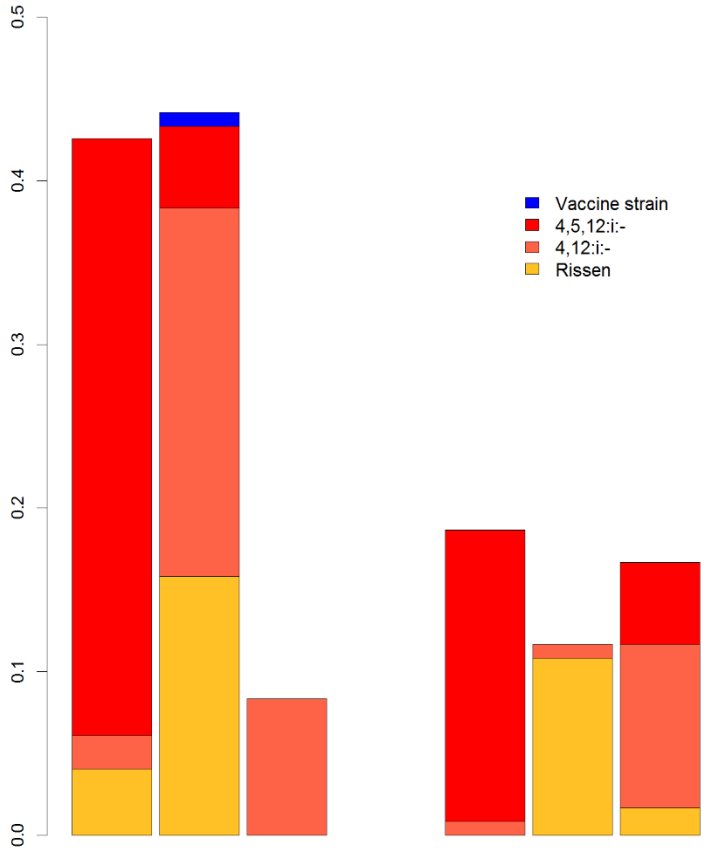
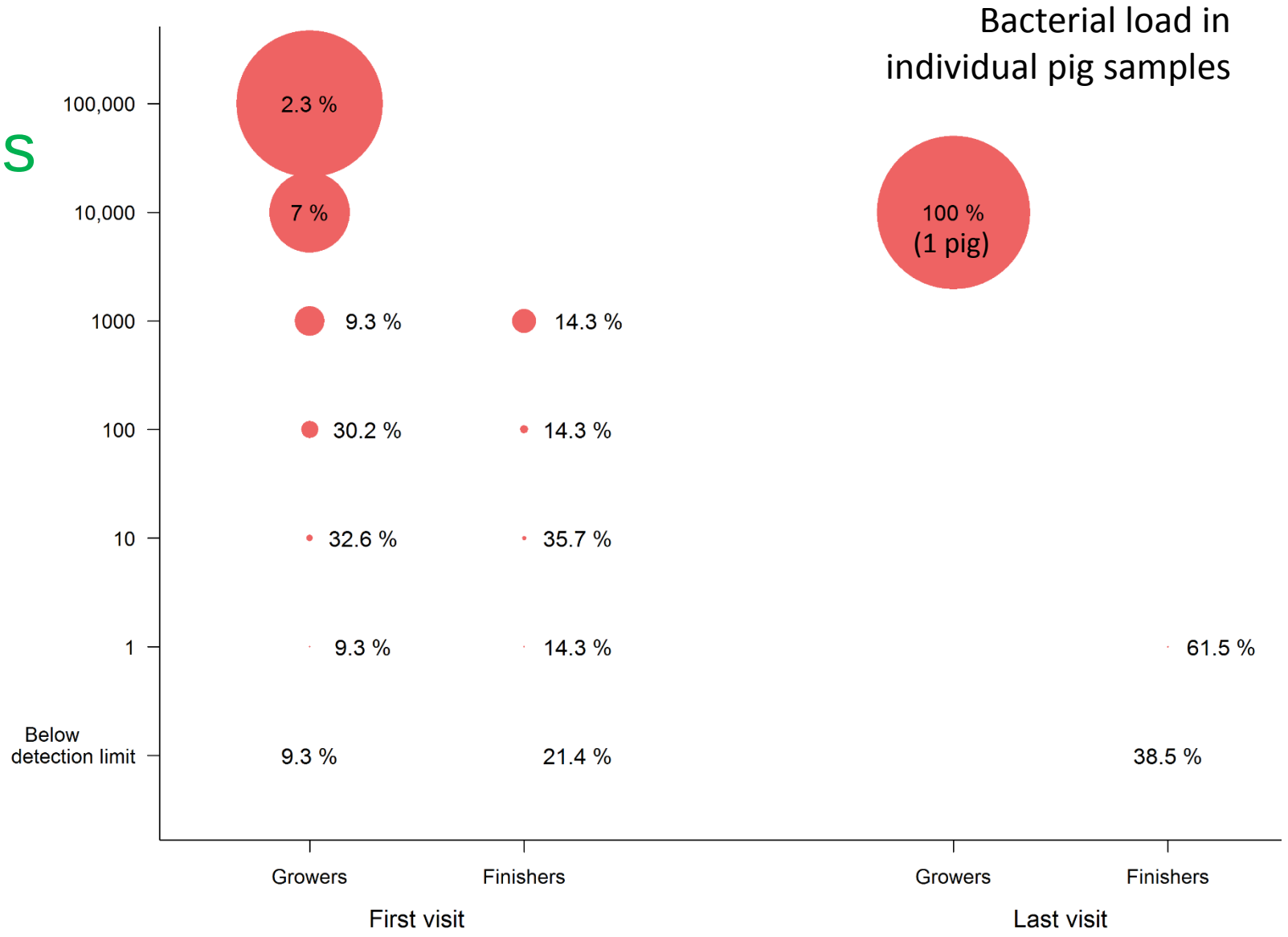
# Surplus finisher farms



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# Conclusions

- Vaccination has improved the clinical situation on the gilt multiplier and supplied farms, and appears to be generally reducing the burden of *Salmonella* Typhimurium on these farms
- Other *Salmonella* serovars (namely *S.* Rissen) appears to be filling the niche
- Further modelling work is needed to fully evaluate the situation on the farms further down the pyramid
  - Longer time period needed, so all breeding animals will have been vaccinated
  - Confusing situation where pyramid does not operate in a closed manner
  - Include economic assessment
- RCT in other breeding pyramids to evaluate more widely

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# Acknowledgements

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